

OUR TREE NEIGHBOURS

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Foreword

THE usefulness of science as a subject of study has indeed been recognized during the last few decades. But now, more than ever, when the country has launched tremendous economic and social welfare programmes which hinge upon the application of the latest advances in science and technology, it has become essential that every citizen should have as much knowledge of science as possible. While science is now being made a compulsory subject at the school level and textbooks based on new concepts of science teaching are being introduced, a textbook can only impart knowledge within the limits of the school syllabus. Therefore, in an attempt to make easily accessible to young minds additional and more comprehensive information in the various areas of science, the National Council is preparing and bringing out a series of supplementary reading materials on science. The present book is one of this series, and I hope that it will be found useful not only by students but by teachers and others as well.

RAIS AHMED

Director

New Delhi

18 February 1976

National Council of Educational

Research and Training

Preface

MORE than a thousand different kinds of trees occur naturally in our country. Some others have been brought in at various times from other near and far off lands and are grown for one purpose or the other. To adequately deal with every one of these native and exotic trees is clearly outside the scope of this little book which, however, does cover some 300 trees which number is many times more than what any other available Indian tree book deals with. Nearly 70 per cent of the trees thus dealt with in this book are illustrated with line drawings, photographs or colour plates. This should greatly help the reader to recognize most of the trees by sight.

The vernacular names given in the index are by no means exhaustive. In a country such as ours with its many languages and numerous dialects, names in all of them for every one kind of tree would add up to a tremendous number that could perhaps by itself run into a small volume. Hence only the more commonly used names are given. Another difficulty with the vernacular names is that of expressing their correct intonation in non-phonetic English.

Name changes are unfortunately all too frequent in botanical nomenclature, so much so that even within a short time current names are likely to get out of date. The botanical names appearing in the text and the index have been brought up-to-date as far as possible. In the index the older but better known names of some trees are given in parentheses wherever

it was felt that the use of the newer names would cause confusion.

I wish to place on record here my sincere appreciation and thanks to Sarvashree S. Doraiswami (since retired) and K. J. Khurana, both of the Department of Education in Science and Mathematics of the National Council of Educational Research and Training, for the fine efforts they put in at various stages in the preparation of the manuscript of this book. My thanks are also due to my colleague Shri K. C. Sahni who read through the final typescript.

CHAKRAVARTI S. VENKATESH

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1

Our Heritage of Trees and Tree Lore

FROM time immemorial man has lived with trees. They have provided him with shelter, wood for fuel, implements of peace or war, fruit, seed and sometimes even clothing. The Banyan and the *Pipal*, the *Neem* and the *Babul*, the Tamarind and the Mango, the *Sal* and the *Dhak*, the *Jamun* and the Myrobalan and a host of other kinds of native trees occur in our vast and varied country. The *Pipal* and the Banyan are planted in many Indian villages and under them the village folk gather or rest. Many roads in the countryside are lined with trees that provide a welcome shade against the hot

summer sun. Our countrymen living near forests or in the hills are fortunate because they live amidst sylvan surroundings abounding in a variety of trees and wild life. Modern and sophisticated though we city folk are, we still love trees and often like to plant them in our homeyards for fruit, foliage or for their beautiful flowers. In towns and cities trees are often planted in gardens and along avenues for shade and for ornamentation. But for them, many city streets would look barren and devoid of a touch of nature.

In India, as perhaps in many other countries of the world, trees have been held in veneration since ancient times. Our Rishis of yore retired to forests to meditate and to do penance amidst trees and "far from the madding crowd". Our forbears loved trees and forests so much so that they even deified and worshipped them as abodes of *Vrikshadevata* and *Vanadevata*. Many of them were not cut without good reason. In ancient India, groves of trees and flower gardens were reared with loving care. They were known in Sanskrit as *Vrikshavatika* and *Pushpavatika*. We learn from his edicts that one of the benevolent acts of the great emperor Asoka was to have avenues and gardens in his vast realm planted with trees in order "to give enjoyment for both men and animals". Immortal poets and writers like Valmiki and Kalidasa have sung in praise of the beautiful denizens of our forests.

Many are the trees that find mention in our scriptures and literature and also feature in our religion and art. A number of these are easily identified as one or the other of those existing in our land today. But there are a few mythical ones like the *Kalpa-Vriksha* whose real existence at any time is

doubtful. This is the Indian wish-fulfilling tree which is supposed to have originated when the *Devas* and the *Asuras* churned the ocean for nectar. What a great wishing-tree it must have been for, like *Kamadhenu*, the heavenly cow, it would, for the mere wishing, produce food, drinks, dresses, ornaments and even beautiful maidens! Today perhaps more than at any other time we would be content if it only gave us enough food, or like the proverbial goose with the golden touch, bore coins of gold in place of its usual fruit. But this is wishful thinking. Then there was *Somarasa*, the drink of the gods, which made them immortal. Some say that one of the ingredients of this drink was extracted from a plant, but which one, we are at a loss to know. Besides, of course, there were other earthly drinks of those days like *Sidhu* prepared from the flowers of the Mahua tree, *Kharjura* from the juice of the Date-palm and *Sura* from various cereals.

Mythical trees apart, there are those that were and still are put to an incredible number of uses. Take, for instance, *Naarikela* the Coconut palm and *Taala* the Palmyra palm, both of which on that account can be called our 'Trees of Life'. Of equivalent use and significance to those in the middle eastern countries then and now is the Date-palm which according to Jewish tradition is their tree of life. There is a reference to the Apple or Apricot tree in the Bible as the one whose fruit Adam and Eve were forbidden to eat in the Garden of Eden. Christians may hence regard it as their tree of life and knowledge. To the Buddhists, the Bodhi tree (*Asvattha*, *Pippala*, *Pipal*) symbolises knowledge because it was beneath this tree in Gaya that Gautama Buddha

sought and found enlightenment. The 'World Tree' of the ancient Chinese was that of Peach.

There are repeated references in ancient Sanskrit literature to the Mango (*Aamra*) as the abode of the *Koel* (Indian Nightingale) and to *Kamadeva*, the love God. A town was named after it as *Aamrapura*, a king as *Aamragupta* and a mountain as *Aamrakuta*. Then there was the celebrated courtesan of the Buddha's times named as *Aamrapali* because as an infant she was picked up abandoned in a mango grove. Twigs of mango held in pitchers containing water were, and still are, used on festive occasions as a sign of auspiciousness. No less important was the banana to which references occur in the epics of the Pali Buddhist Canon of 500-600 B.C. Its high yield and great nutritive value were no doubt responsible for its popularity. The sages of yore ate its fruit. Even today, on auspicious occasions, especially in the south, while the cut banana trees adorn doorways, the fruit are given as gift and the leaves are used as plates and *Donas*. Kalidasa in his drama *Vikramorvasiyam* gives a poetic allusion to the Banana plant thus—"This fresh Kadali plant with its flowers having reddish streaks on them and with water inside reminds me painfully of her eyes full of tears through anger".

The *Pipal* and the *Banyan* (*Nyagrodha*) are deified and worshipped to this day. The former symbolises Vishnu to Hindus and is the 'Tree of Knowledge' or the Bodhi tree to Buddhists. Both are represented in stone sculptures of early days. The *Atharvaveda* speaks of gods of the third heaven seated under the *Asvattha* tree. Soma vessels and the sacred fire-drill are said to have been made out of its wood. *Udumbara* (*Ficus*

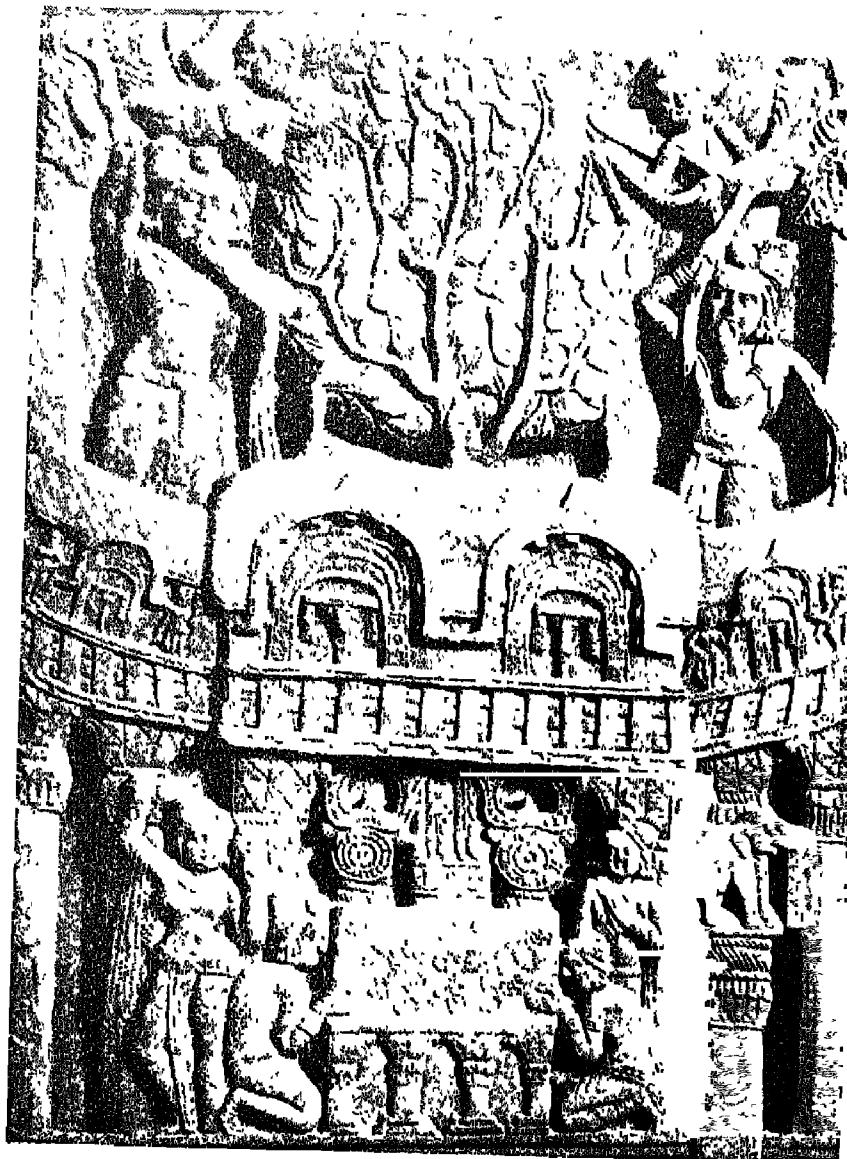


Fig. 1.1 A sculpture depicting worship of the Bodhi tree

racemosa) another wild fig-tree also seems to have been held in worshipful regard.

Some of the several other trees that find praiseful mention in our scriptures, literature and also at times feature in ancient art, are the *Asoka* (*Saraca asoca*), *Kadamba* (*Anthocephalus cadamba*), *Champaka* (*Michelia champaca*), *Naagakesara* (*Mesua ferrea*), *Paarijaata* (*Nyctanthes arbor tristis*), *Siriṣa* (*Albizia lebbeck*), *Sala* (*Shorea robusta*) and *Vakula* (*Manilkara hexandra*).

The red-flowered *Asoka* was held in great esteem and no garden was regarded complete without it. While in exile in Lanka, Seeta was confined by Ravana in *Asoka Vana*, a grove of *Asoka* trees. This beautiful tree is usually associated with young and beautiful women and it was believed that only their touch could make it flower. In what was known as the 'Dohada' ceremony lovely damsels were invited to kick or press the trunk of this tree with their left foot in order to hasten its flowering. Kalidasa mentions a spring festival known as 'Asoka-pushpa prachaayika' when young women gathered the red flowers of this tree and decked their jet black hair with them. In his play *Malavikagnimitra*, the heroine Malavika who is in love with Raja Agnimitra, dances under an *Asoka* tree and hits it with her left foot appearing to induce it to flower.

The *Kadamba* whose flowers appear in golden balls, was another favourite tree of those days. It is closely connected with the life of Sri Krishna who is often depicted standing under a *Kadamba* tree in full bloom with his beloved Radha by his side. It also finds mention in the *Mahabharata* as occurring in the Kamyak forest south-west of Indraprastha. The *Kadamba*

dynasty (4th-11th century A.D.) of kings of South India derived their name from it.

The *Champaka* is still a favourite with South Indian women today as also the flowers of the Nagkesar or the Naga tree with women in Bengal and Assam.

Paaryata or *Shephalika* of Kalidasa's *Ritusamhara* according to Hindu mythology sprang up along with nectar when the ocean was churned. Another legend has it that this tree once grew in heaven in the courtyard of Indra's wife Shachi from whence it was brought by Krishna at the instance of Satyabhama and planted at the latter's residence in Dwaraka.

The fragrant star-like flowers of *Vakula* were and still are used for worship. It finds mention in the *Mahabharata*.

Trees associated with the Buddha's birth are *Sala* (*Shorea robusta*), *Asoka* and *Plaksha* (*Butea monosperma*). Of these, *Shorea robusta* and *Butea monosperma* occur commonly in the Nepal *Terai* where he was born near Lumbini, in a grove of trees.

In Kalidasa's *Ritusamhara* we get a charming description of most of our beautiful native trees that flower from month to month.

There are many references to the forest trees of India in Valmiki's *Ramayana*. The sage lists several plants of the Chitrakuta hills while describing the journey from Ayodhya of Rama, Lakshmana and Seeta. By the miraculous powers of his *Tapasya* the sage Bharadwaaja is said to have created a whole park to accommodate Bharata and his entourage when they came from Ayodhya to persuade Rama to return. The description of Agastya's ashrama and of Panchavati provide

additional information. There is also a most moving account of the wanderings of grief stricken Rama asking the trees, shrubs and creepers of the forest if they had seen his beloved Seeta. The descriptions of some of these plants are remarkably accurate.

It appears that the ancient Hindus, like the Babylonians, had some inkling of the presence of sex in plants. For example, the male plants of the Screw-pine (*Pandanus*) were called *Ketaki-viphala* or *Dhulipushpika*, the female as *Svarna Ketaki*, and the male and female together as *Ketakidvayam* meaning a pair of Ketakis.

The use of the oil obtained from *Ingudi* (*Balanites aegyptiaca*) as a soothing balm is mentioned by Kalidasa in his *Shakuntalam*. Ascetics in hermitages used this oil for lighting lamps and for the preparation of ointments. *Valkal*, the traditional garment of the early Aryans was made from the bark fiber of *Nyagrodha*, *Asvattha*, *Udumbara* and *Vetasa* (Canes). Mention of it occurs in the *Vanaparva* of the *Mahabharata* when the exiled Pandavas discard their princely robes and don the rough *Valkal* for their life in the forest. Kalidasa's *Raghuvamsa* also mentions of this rough cloth woven out of tree bark.

Vilva (*Aegle marmelos*), *Amalaki* (*Emblica officinalis*), *Abhaya* (*Terminalia chebula*), *Devadaaru* (*Cedrus deodara*), *Lodhra* (*Symplocos crataegoides*), *Nimba* (*Azadirachta indica*) and a host of other native trees find mention in works on early Indian *materia medica*, i.e., the *Ayur-veda* and *Caraka Samhita*.

Tree worship continues to this day among the devout and the religious, and among our rural folk. Pride of place goes to the *Pipal* which is revered in almost every part of India. A symbol

of Vishnu, women worship it, circumambulate (*Pradakshina*) it, wrap yards of cotton on its trunk and pour water and sometimes milk over its roots. In Mysore a stone platform is erected beneath the *Pipal* on which three snake stones are placed which are worshipped as symbols of fertility particularly by childless women. Sometimes the *Pipal* and the *Neem* are grown together and the two are ceremoniously married. In tribal Orissa, where traditional tree worship is still very strong it is the *Pipal* and the Banyan that are thus married. In Punjab and Rajasthan it is the *Jand* (*Prosopis spicigera*) which is the fertility-bestowing tree and is worshipped for children by women. Flags and streamers offered in worship usually hang from these trees. In the high Himalayas, in Kulu, the valley of the gods, as well as in Kumaun it is the local *Deodar* which is held sacred and shelters many temples. Here pieces of iron are offered for worship and it is common to see many *Deodar* trees studded with iron nails.

Worship apart, there is now more than at any time the need to plant more trees in vacant lands, ravine land and where forests have been cut down or destroyed in the past. Every year a countrywide *Vana Mahotsava* (our Arbor day) festival is celebrated when trees are ceremoniously planted in such lands. It is not however enough if trees are just planted and forgotten. In the earlier years of their life they need to be tended and protected from browsing animals. Indeed if every one of us does so, our country will be richer by several million more trees that will not only give us many of our daily needs but at the same time will enliven and beautify our surroundings and save our other natural resources for our children and for posterity.

The Life of a Tree

ATREE hardly needs definition. It is a long-live (perennial), large woody plant usually with a single main stem, the trunk, which gives off spreading branches, twigs and the foliage to make the crown of the tree. However, there are exceptions to this general rule. Palms are typically unbranched trees with only one trunk ending in a crown of large leaves. Bamboos, on the other hand, are trees without a main trunk but with a cluster of culms issuing forth from the underground rhizome. The Banana plant is an exception in another way. It has only a thick false or pseudo-stem which is not woody but is made of

a central core of soft tissues concealed by the fibrous and sheathing bases of the large leaves. Thus, structurally, the banana plant is made of a giant herb than a tree.

Life Span of Trees

How long does a tree normally live ? This varies with different kinds of trees. Usually trees take a long time to mature but thereafter live for several years till they grow old and die. More often, they come to a premature end at the hands of man who cuts them away for one reason or another. Lightning and fire, insects and diseases are other enemies of trees.

Our Himalayan *Deodar* can live up to a great age. A cross-section of an old veteran of this species kept at the Forest Research Institute, Dehra Dun, shows 700 distinct annual growth rings. The tree was born some time during the depredation of Alauddin Khilji in the 12th century A.D., lived throughout the Mughal period of Indian history and the greater part of the British domination of our country. Some of these very old specimens have been used to date past climatic cycles and connected sunspot activities. In Joshimath on way to Badrinath there still stands a tree of Mulberry (*Morus serrata*) which probably dates back to the 8th century A.D. It was under this tree that the great Hindu religious preceptor Aadı Sankaracharya is said to have sat and meditated during his stay there. The tree would thus be more than 1,200 years old. Recently a teak tree cut down in the Kakankote forest of Mysore showed 680 annual rings. The famous banyan in the Indian Botanical Gardens at Sibpur, Calcutta is 200 years old and is still alive.

Another old giant of a banyan tree stands at Adyar in Madras.

Vigorously growing centenarians and bi-centenarians of many other tree species are also known from different parts of our country. But in sheer longevity as well as in giant size no living being on this earth today can equal the giant Redwood (*Sequoiodendron giganteum*) trees of California on the West Coast of the United States of America. Several of them have lived for over 2,000 years, the oldest among them like the one named the Grizzly Giant is nearly as old as 3,500 years. They must have first taken root when the pyramids were being erected in ancient Egypt and when Buddha was born in our country about 400 B.C. Some of these veterans were nearly middle-aged. Quite a few of these silent and stately sentinels of time tower over 231 metres in height and the trunk measures 9-12 metres at the base. Through the base of one of these still living and growing trees, the Wawona Tree, a tunnel was cut which was wide enough for a large size car to pass through. This "Tunnel Tree" has presently fallen, after living for 2,000 years. Some even older trees of the Bristlecone Pine (*Pinus aristata*) have been recently discovered growing on the 3,500-metre high windswept rocky slopes of the white mountains of California where it rains little, but snows most of the year. Although some of them have been in existence for 4,600 years, they have grown very slow under their hard native conditions and are no more than 3.5 metres high. Others may reach 10.5 metres. Thus, although they are mere battered dwarfs of dry rocky wilderness, in sheer age they surpass the giant redwoods by many centuries.

How are trees able to grow to such a great size and live so long ? What is their secret ? Answers to these questions are to

be sought in the peculiar anatomy and growth habit of trees. The extremities of trees and certain tissues in their interior are ever young and ever active. It is by multiplication of the tiny cells in these parts that trees are able to keep growing almost indefinitely both in height and girth. This very capacity also bestows upon them a long life. If we human beings were able to continue growth like trees we would all be giants.

How a Tree Lives?

The principal vegetative organs of a tree that keep it alive and growing are the roots, the stems (including the trunk) and the leaves. Roots are the underground structures that penetrate deep into the soil. They enable the tree to firmly anchor its large and heavy body in the ground and at the same time absorb water and minerals from the soil. Unlike the roots of most herbs which penetrate only the top layers of the soil, the roots of trees, as a rule, penetrate much deeper into the soil. Therefore tree roots absorb water and nutrients even from the deepest regions of the soil which most herbs are unable to do. This fact also accounts for the needlessness of frequent irrigation of planted trees.

The trunk which is the main stem gives off successively small branches to produce the intricate framework which acts as the skeleton of the tree, supporting tonnes of foliage and fruit. Leaves, the most numerous of all the organs, manufacture the food essential for the tree's growth. This they do with the green pigment in them. The raw materials for this food manufacture are the carbon dioxide present in the

atmosphere and the water that the roots absorb from the soil. Another essential requirement is sunlight from which the food manufacturing process derives its name of photosynthesis. The type of food manufactured is of the nature of carbon compounds which are known as carbohydrates. Hence also the name of carbon assimilation for the process.

Evergreen and Deciduous Trees

In some kinds of trees, like the Mango and the Conifers, all the three vegetative organs are present all times of the year. They are known as evergreens. Others shed their entire foliage during part of the year. They are called deciduous trees. Many of our trees occurring in the plains are partially or wholly deciduous like the Semal, Flame of the forest or the Indian Laburnum. They lose their foliage prior to or during the dry hot season and thereafter put on new foliage in the following seasons. In Willows, Poplars, Elms and other similar (broad-leaved) trees of colder parts of the world, such shedding of leaves occurs in autumn, which season is therefore often referred to as the 'Fall' in those regions. During the severe snowy winters of these areas these trees consist only of roots and the bare leafless stems, and may appear apparently dead. However, the stem bears dormant resting buds of the new foliage which remain concealed till they emerge the next spring. In our country such winter deciduous trees are naturally found in the higher elevations of the Himalayan mountains. Thus if you visit Kashmir in winter, you will find the familiar Poplar and Chinar trees standing like ghosts draped in snowy white.

It must be realised that although an evergreen tree bears leaves all the year round it does shed its older leaves which however keep on falling, off and on, but never all at one time. Some trees may be said to be partially evergreen, that is, although they are never quite leafless like the true deciduous trees, they have more leaves in the moist season than in the hot dry season.

What is Wood and How it is Formed?

The bulk of the material that the trunk, branches, and twigs of trees are composed of is wood which is familiar to all and finds numerous uses in our daily lives from the fuel we burn in the fireplace, to the doors and windows of our homes, cots and other pieces of furniture and the benches and desks in our schools. In the tree itself wood serves two vital functions. It forms as it were its supporting skeleton giving the trunk its strength to bear an enormous weight and to resist the stress of wind and weather.

The microscopic examination of wood (Fig. 2.1) reveals several kinds of tissues among which are the thickwalled tubes serving as channels for the sap circulatory system of the living tree. In sections and under the high magnification of a microscope these tubes appear as larger and smaller pores. The seedling of a tree has no wood worth the name. Its soft tissue is however sufficient to support the frail axis and its few leaves. In mature plants the tubes serve both for the upward flow of water from the roots to the leaves and for the downward flow of sap from the leaves or other regions. A herbaceous plant does not grow much more than this but a tree does, adding

more and more foliage in succeeding years. At the same time the stem increases a little in diameter each year and gradually becomes woody. Both this diameter growth and addition of wood is caused by the activity of a special growth layer called the *Cambium* which is capable of producing new conducting tubes as well as special supporting cells which all together constitute the wood. The conducting tubes in the wood are very thickwalled and are themselves able to lend some support to the stem. Each year the cambium cylinder moves outward a little, producing a new woody tissue inside. As the growth in diameter of the trunk continues, more and more of wood is added, which acts as a supporting skeleton for an increasingly growing weight of branches and foliage. The cambium tissue outside the woody core forms a hollow cylinder just beneath the surface of the stem. Immediately on its outside it produces some amount of softer tissues which are chiefly concerned with the conduction of sap.

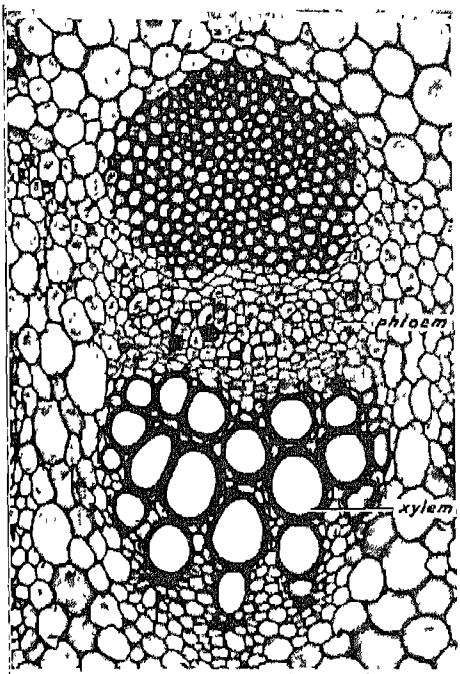


Fig 2.1 Microscopic view of wood

Suppose you drive a spike or nail into the trunk of a growing tree, say at a height of a metre from the ground level. A few years later will you find the spike or nail at the same level or a few centimetres higher up from where you had first fixed it? The answer is that you will find the spike or nail at the same level as before. This is because the growth of trees in height is confined to the tips or buds of the main shoot and branches. Elsewhere the tree grows only in girth due to activity of the cambium. This increase may gradually move the spike or nail sideways but not vertically and may eventually engulf and completely bury it in the expanding layers of wood.

Even a casual examination of the cut end of a felled trunk or the main branch of an old tree often reveals three well marked zones—a darker coloured core of wood, the *Heart-wood*, a lighter coloured zone of wood, the *Sap-wood*, immediately outside this core and covered in its turn by the bark (Fig. 2.2). The heart-wood usually has lost its function of conduction, the tubes in it having become clogged up with ingrowths called *Tyloses* from surrounding tissues or by various kinds of substances like tannin, oil, etc., stored in it and accounting for its usual darker colour. The sap-wood is still alive and performs vital functions of the living tree. The heart-wood is harder and tougher than the sap-wood and hence is usually the more valued for timber. When the formation of the heart-wood has begun it continues fairly regularly each year by the conversion of the inner sap-wood into the heart-wood.

A familiar feature of the wood of many trees is the series of rings which begin as small circles towards the centre of the stem and become larger and larger as the bark is approached.

These are the growth rings which denote successive growth increments of the stem due to intermittent activity of the cambium. Such growth rings are especially marked in trees that have lived in areas with alternate periods of marked growth and relative inactivity of the cambium during the year. Thus, in trees

growing in the higher Himalayas and in higher latitudes of the world where winter is very severe the conducting tissues formed most recently before winter when growth activity of the cambium ceases, are of smaller diameter. When growth is resumed in spring the first tubes formed are of greater diameter and have thin walls. This results in a rather clear-cut boundary between the last formed *Summerwood* and the recently formed *Springwood* giving the entire wood a clearly ringed appearance. In such climates with one growth period and one rest period a year, these growth rings are in fact annual rings, one being formed each year. These annual rings are

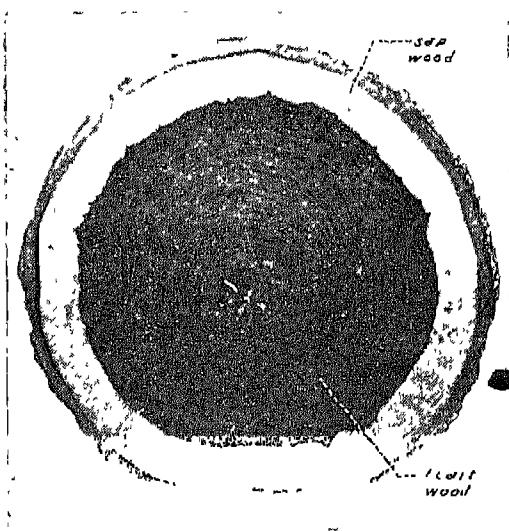


Fig 2.2 Cut end of a trunk or log of a tree to show demarcation into heart-wood, sap-wood and bark.

very useful in estimating the approximate age of a tree, in years.

The hardness or softness of a wood determines its suitability for various uses as timber. These properties in turn are characteristics of a species, and are determined by the size of its growth rings, the nature of their conducting cells and other physical and chemical properties.

Bark of Trees

The stem of the sapling of a tree bruises easily but not so after it has grown considerably in thickness and has turned woody. This is because as it grows in girth it acquires a durable protective covering, the bark. The bark is made of different kinds of tough tissues and is almost impervious to water. It can withstand a considerable amount of wear and tear and is being constantly replenished from inside by a special cambium. As the trunk and the main branches increase in diameter with the addition of new wood within, the bark is put to a slow but sure tearing strain. It has to keep pace in order to accommodate the expanding growth. This it does not only by growth but also by splitting open. As a result the bark of most trees is furrowed, shredded or it peels off in layers. The bark of trees varies considerably in thickness, texture and general appearance. Many trees therefore can be identified by their bark alone.

The Food Factory of Leaves

Each green leaf on a tree is a well-constructed miniature food

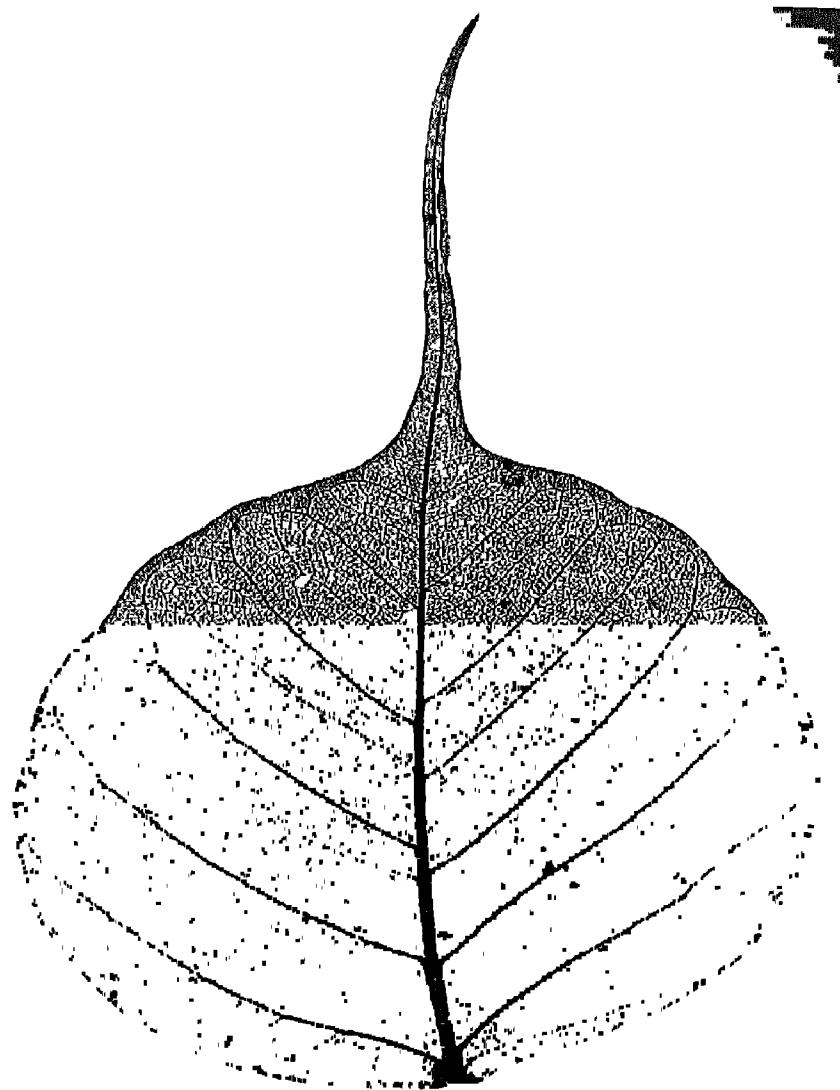


Fig. 2.3 Pipal leaf skeleton showing the intricate ramification of the vascular system in the leaf blade.

factory. Using carbon dioxide of the atmosphere and the water absorbed by the root as raw materials and sunlight for energy, the green pigment of the leaf called *Chlorophyll* is capable of synthesizing basic carbohydrate food. The complex chemical process by which this takes place is photosynthesis already referred to. Oxygen is released as a by-product. Hence the highly beneficial capacity of green plants of purifying the air we breathe in, by keeping the supply of oxygen in it is continuously replenished.

Not only the leaves but all other green parts of a tree exposed to light are capable of photosynthetic food manufacture. However, since leaves are the most abundant of all such green organs, they are the principal food manufacturing organs of a tree. With so many of them the total output of food of a tree should be enormous but this is necessary for its growth to the large size it usually attains unlike a small, short-lived herb.

The Vascular System of Trees

The tree has a circulatory system of its sap although this is not exactly comparable to the blood circulatory system of our body. The tree does not have anything like a heart to pump its vital fluid within its body but it does have two kinds of tubes called *Xylem* and *Phloem* (See Fig. 2.1). *Xylem* conveys the water with the dissolved salts that the roots absorb from the soil to the far corners of the leafy canopy of the tree. The food that the leaves manufacture by photosynthesis is conveyed downward to the stem and roots by another system of tubes

which constitute the phloem. In the stem and the thicker roots the phloem usually lies outside of the xylem and towards the bark. Elsewhere in the tree also the two tissues occur close together and form a continuous circulatory system extending from the extremities of the roots to those of the leaves. In the leaf itself the presence of these tissues appears on the surface as the familiar network of veins.

Besides the water that they use in photosynthetic food manufacture the leaves of trees lose water from their surface by evaporation in the same way as we lose water from our bodies by sweating. Especially on bright and hot sunny days, substantial quantities of water are thus lost to the atmosphere. This loss is to be made good if the tree is not to wilt and die. In fact the water needs of the foliage and the loss through them is constantly replenished with fresh supplies from the roots which most continuously keep absorbing water from the deepest regions of the soil. But how is this upward transport of water against the downward pull of the earth's gravity achieved?

A certain amount of pressure is developed in the roots which partly causes the water to rise in the stem. Added to this is the upward suction pull exerted by the leaves following the loss of water by them by transpiration. The tubes in the xylem which convey the water are so slender that they can support tall columns of water by the physical phenomenon of surface tension. All these forces operating together are believed to be sufficient to raise water from the roots in the soil to the extremities of the leaves even in the tallest of trees that may tower well over 50 metres from the ground.

Reproduction of Trees

Unlike higher animals, many trees can be vegetatively (asexually) propagated. This unique faculty of trees and other plants enable their rapid multiplication without seed. Some trees naturally propagate themselves thus by suckers or coppices but more often, we propagate them by cuttings, layerings and by grafting. In fact some of our best varieties of fruit trees like the Mango and the Orange are raised as grafts.

In nature, all trees reproduce sexually by means of flowers and seed. Pines and their relatives bear no flowers but equivalent structures known as cones which serve the same function. A typical flower consists of a concentric series of parts. The outermost of the series which is normally green consists of three, four or five sepals that are free from one another or are united. The sepals collectively are called the calyx. The next series of parts which are usually the most conspicuous part of the flower by virtue of their bright colours is called the corolla. It consists of free or united petals. The sepals and petals do not take any direct part in reproduction but nevertheless serve useful accessory functions when they are present. The calyx which in the flower bud usually encloses all the other organs acts as a protective covering for them. The brightly coloured petals attract insects which play a vital role in the transference of pollen from the male to the female reproductive organs. For this purpose many flowers possess additional attractions for insects in the form of nectar and fragrance. The corolla in its turn encloses the male and female reproductive organs of the flower respectively known as the stamens and the pistil. The

number of stamens present in a flower depends upon the particular species of a tree we are concerned with and can be an aid in tree identification much as the number of sepals, petals and parts of a pistil do. Each stamen consists of a slender stalk, the filament, carrying a head, the anther which produces a yellow mass of minute reproductive bodies known as pollen. The innermost and central series of parts in a flower are collectively called the pistil. Within its swollen basal end which is known as the ovary occur the female reproductive bodies or the potential seeds known as the ovules. The pollen are carried from the anthers to the stigma, the receptive tip of the pistil on which they germinate, to give out tube-like structures. These pollen tubes penetrate the tissue of the pistil and convey the male cells into the ovules where sexual union or fertilization occurs between them and the eggs. The fertilized egg develops into an embryo, the germ of the future tree, the ovule develops into the seed and the entire ovary ripens into the fruit which is not necessarily edible and would often not be popularly considered a fruit. In the Conifers and their relatives where there is no ovary enclosing the ovules only seeds are developed and there is no fruit in the real sense.

The great majority of our trees are bisexual, bearing both the stamens and the pistil in the same flower or in separate flowers or cones on the same tree (e.g. Conifers, Coconut palm). However, there are a few exceptions like the Willows, the Palmyra palm and the Date-palm where the male and female flowers occur on different trees. In such cases, therefore, separate male and female trees are distinguishable. Thus there is a Mr. Date Palm and a Mrs. Date Palm! This is also true of the Palmyra

Palm. That plants also had sex like animals was first suspected in the Date-palm by the early Hebrews and Babylonians.

The transference of pollen from the anther on to the stigma is known as pollination and is essential if fertilization and seed formation are to occur. Insects, birds and wind bring about pollination of trees. Conifers and Bamboos as a rule are wind pollinated.

Many of the reproductive events outlined above can be seen only under the microscope and are not visible to the unaided eye. However, the progress of these events within the flower is signalled by readily visible external changes in the flower following fertilization. The petals and stamens wither and drop off. The sepals likewise may wither and be lost or may persist in the fruit. Sometimes they not only persist but enlarge considerably as in our *Sal* tree and help in the dispersal of the fruit. The most universal and obvious change noticed, however, involves the ovary. It enlarges and matures into the fruit. A mature fruit contains full grown seeds within and the seeds in turn contain the embryo.

Many dry fruits burst, when mature, to release the seeds. The fleshy fruits are either eaten whole by birds and other animals and the seeds voided or the fleshy covering alone is eaten and the seeds cast away. In either event, the seeds are dispersed far and wide from the parent tree by these animals. In still other cases the winged fruits or seeds are borne afar by wind currents.

The Tiny Seed Contains the Germs of a Mighty Tree

Seeds of many trees are no larger than those of a bean. Yet

each of them has potentiality to grow for forty or more years and attain sometimes a gigantic size. Thus, however tall and large a tree may eventually grow up to be, to start with, it is but a tiny seed. The tree seed upon germination gives a seedling which is no taller than a herb. But while a herb stops growth there and may soon die away, the tree seedling grows year after year becoming a sapling first which in due course matures into an adult tree whose life span normally stretches from 10 or 20 to 100 years, sometimes to hundreds of years as in the case of the exceptionally long-lived Redwood trees of North America. To attain this great age needs long and patient growth of the tree and its survival at the very spot where it first struck root because unlike animals, plants are generally incapable of locomotion.

Superstitions about Trees

Several quaint superstitions are associated with many of our trees. Ghosts and evil spirits are supposed to dwell in some of them. Village folk have a prejudice against sleeping under a Tamarind tree because they believe it exudes unhealthy vapours and is the abode of evil spirits. It is also said that a few plants survive under a Tamarind, *Pipal* or Banyan tree.

There is one scientific fact which makes it rather undesirable to sleep under any tree after dark. Like animals trees also respire and the by-product is the same in all cases, namely, carbon dioxide. During day-time carbon dioxide thus produced by the tree does not accumulate to any appreciable extent because

it is used up in photosynthesis and oxygen is replenished. But there is no photosynthesis in darkness and hence especially on still nights the concentration of carbon dioxide under a tree is likely to build up and thereby pollute the air around. Therefore, while it is quite alright to sleep or rest in the shade of a tree on a bright sunny day it is inadvisable to do so after dark.

As for survival of other plants under a tree, because of the more or less dense shade cast by a tree only shade-tolerant plants can usually thrive under it. Even in dense forests there is usually some undergrowth of shade-loving shrubs, herbs, ferns, etc.

Uses of Trees

There are innumerable ways in which trees make themselves useful to man. The tree product that is of the greatest and widest usefulness is wood obtained from the trunk and branches of trees. The chief uses of wood are as fuel (burnt as such or converted into charcoal), and as timber for house posts, beams, shipmasts, boats and rafts, doors, windows, flooring, wall panels, plywood, hardboard, furniture, boxes and crates, vehicles (bullock carts, tongas, etc.), railroad sleepers, etc. In addition to these direct uses of wood, there are many indirect uses of various individual compounds extracted from wood. Wood cellulose is used in the manufacture of paper, rayon, shatter-proof glass, cellophane, photographic films, synthetic lacquers and plastics. By distillation of wood acetone, wood alcohol, wood tar, wood gas, oils (Sandalwood oil, for example), turpentine

and other materials of great industrial value are obtained. Trees add beauty to the landscape or garden, provide shade and some bear beautiful blossoms too. Several of them yield edible fruits like Mango, Apple, Guava, Sapodilla, Custard Apple and so on or edible seeds like Almond, Cashewnut, Walnut and Coconut. Resin, gum, oil, dye, tannin, rubber, cork, drug, perfume, fibre and other products are also derived from various parts of different trees.

How to Recognize Trees ?

ALL trees have something in common. They have roots, trunks, leaves, produce wood and provide for offspring by reproductive structures in the form of flowers or cones, fruits and seeds. This does not mean that all of them are alike. Many of them differ to such an extent that they can be recognized at first sight from other trees. We all are able to tell just by sight, at least one or two trees even when they are not flowering. Several others, however, need closer study before we are able to recognize them as of one species or the other. To know all of more than 1,500 different kinds of trees native to our

country one has to be a botanist who precisely names every kind of tree he finds whether it is useful or not.

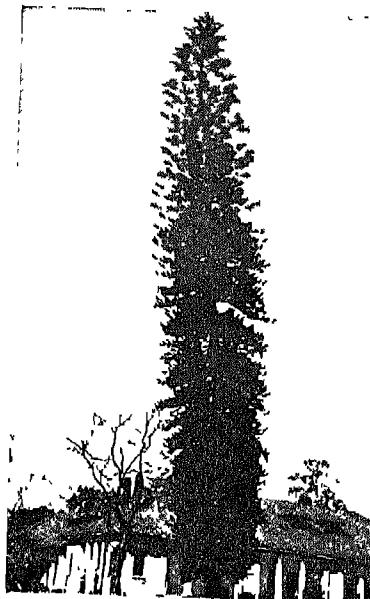
To the casual observer, a tree is simply a tree. How then is it possible for one who is interested, to recognize each species? One can become skilled in identifying trees if he goes about the task in a scientific fashion. There are many individual features of trees such as, let us say, the size, number and curvature of the branches but these are of little value in recognition because they are not identical in all trees of a species. The secret is to know what features to look for and which ones are reliable guides to a tree's identity. We can call these the "identification tags" of a tree. This means that you must develop the scientist's habit of careful observation of details which might be overlooked by a hit-or-miss approach.

A very few trees can be accurately indentified by their vegetative features alone. It is usually a combination of these with various reproductive structures which will enable you to distinguish a *Neem* from a Bead tree or Tun, a Chir Pine from a Kail Pine. As a rule, the more unlike two trees are, the easier it is to distinguish the one from the other. The Mango and the *Neem* trees are quite different from each other and there is usually little difficulty in recognizing one from the other even from a distance. On the other hand, many Fig trees of our country are more closely alike and hence it needs keener obser-vation and study to distinguish the different species of them barring of course such obviously different ones like the *Pipal* whose distinct leaf form readily gives away its identity anywhere.

Tree identification is fascinating, much like the task of a detective in tracking down people. Each tree species like every



A



B

Fig. 3.1 The three types of branching of trees

- A. Palm type
- B. Conifer type
- C. Sympodial type



C

person, is a combination of certain features, all of which add up to that particular kind of tree.

The most important vegetative parts of a tree for purposes of tree identification are leaves, bark and trunk. And the most important reproductive structures are flowers (or cones) and fruits. At various seasons of the year you will have to depend upon the organs which are then present; thus a knowledge of all the features which are typical of a particular kind of tree is necessary.

The General Appearance of Trees

We all know certain kinds of trees which have such a distinctive appearance that they can be recognized from this alone. The growth pattern of the trunk and branches may result in an outline for the tree as a whole which makes recognition possible from a distance. This growth habit is determined by the location of the growing points and the extent of their activity, resulting in three types of branching. In one type the stem produces buds only at its tip, not along its length. The result is a tall unbranched trunk with a cluster of leaves at the top, as in the Palms (Fig. 3.1A). In a second type the stem produces buds along its length as well as at its tip but the growth of the terminal bud is more vigorous than that of the lateral buds which are to become the side branches. As a result the trunk elongates faster than the branches, producing a tall straight central axis supporting a cone-shaped mass of branches and foliage widest at the base and tapering to a pointed tip (Fig.

3.1B). This type of growth prevails among the Conifers and is well suited for shedding ice and snow that accumulate on these trees during the cold winter in their native habitats.

A third type of branching (Fig. 3.1C) results when the lateral buds grow at an equal rate to that of the terminal bud, or when the terminal bud is absent. In this case there is no main central trunk, once branching has begun. The foliage mass is broader than tall, resulting in a dome-shaped or irregular outline. Trees with this growth habit often are wider at the top than at the bottom, an excellent shape for intercepting the maximum amount of sunlight. This is the habit most often seen in our trees.

Within the foregoing three general branching habits of trees there may occur individualities in particular species. All too frequently, lopping or pruning of the branches by man or natural injuries such as those caused by lightning or rainstorms bring about changes in the appearance of individual trees thus affected. On windswept sea coasts and high mountain tops where there are strong one-sided winds, the trees develop asymmetrical crowns and may often be stunted in growth. Even the trunks may get misshapen. By a careful and constant pruning and various other treatments the Japanese have perfected the art of *bonsai* or "tailoring" living trees to miniature dwarf size fit for keeping in the window of the drawing-room (Fig. 3.2). A hundred-year old *bonsai* pine may be no more than 60 centimetres in height.

It is surprising how many trees you can recognize just by sight and appearance even when you see them from a distance or catch a quick fleeting glimpse of them from a moving train



Fig 32 Bonsai Pipal tree



Fig 3.3 A. Simple leaf
B & C. Pinnately compound leaves
D Palmately or digitately compound leaf
E. Bipinnate compound leaf
F. Tripinnate compound leaf

or bus. After becoming familiar with the features like leaves and flowers of a tree at a close range walk some distance away and observe the tree as a whole. Its personality can then become an additional "identification tag" the next time you meet it.

The Personality of Leaves

Both individually and collectively leaves add up considerably to the personality of a tree species. There is a great variety in size and shape of leaves but at least two broad categories stand out prominently—the relatively thin and broad leaves of most of our tropical species and the thick, narrow or needle leaf of the Conifers and their kin. Some of the latter like the Cypresses and the Cedars have their leaves in the form of small over-lapping scales. In a few exceptional non-Conifers, the leaves may be reduced to scales as, for example, in the Casuarina and the Tamarisks. Some plants like the Banana and the Palms have exceptionally large leaves.

Within the general category of broad-leaved trees there are some in which the leaf is all in one piece even though it may be more or less deeply divided along its margin. When this is so the leaf is called a *Simple leaf* (Fig. 3.3A). Some of our common trees with such simple leaves are the Mango, the *Pipal* and the *Banyan*. When the leaf is not in one piece but is clearly divided into several sections it is said to be a *Compound leaf* (Fig. 3.3B-F). This is the case with the leaves of the *Neem*, the *Tamarind*, the *Babul* and the Red Silk Cotton tree. Individual segments of a compound leaf are known as leaflets. A

striking difference will be noticed at once between the leaves of the *Neem*, the Tamarind and the *Babul* on the one hand and those of the Red Silk cotton tree on the other. No doubt all of them are compound but the arrangement of leaflets is different. In the *Neem* and the *Babul* the leaflets arise from the common axis in two rows much like the bristles in a feather. They are hence described as *Pinnately compound* (Fig. 3.3B,C). But those of the Red Silk Cotton arise from the same point at the tip of the leaf stalk somewhat like the fingers in the palm of our hands. Such leaves are described as *Palmately compound* (Fig. 3.3D). Again, in the *Neem* the leaflets of the pinnately compound leaf arise directly from the main axis but in the *Babul* this axis is further subdivided into secondary axes bearing the leaflets. The latter kind of twice pinnately compound leaf is described as *Bipinnate compound* (Fig. 3.3E). The *Gul Mohar* is another good example of this kind of leaf. Rarely the leaf is thrice compound as in the Drumstick tree (Fig. 3.3F).

If for the moment we limit our observations to simple leaves, we discover a number of ways in which leaves of one species differ from those of other species. These important differences involve the outline of the leaf, its type of margin and tip and the method of arrangement on the stem and branches.

The outline of the leaf is a fairly reliable identification tag since, whether the leaf is large or small, young or old, it usually possesses a distinctive shape established by heredity of a particular species of trees. Thus, for example, although the *Pipal* and the Banyan both have simple leaves with undivided margin you will have little difficulty in recognizing one from the other because of the differences in the outline of their

leaves. That of the *Pipal* has an egg-shaped outline and a long drawn out tip whereas the leaf of the Banyan is elliptical with only a short acute tip. There are a number of technical names for describing the various characters of a

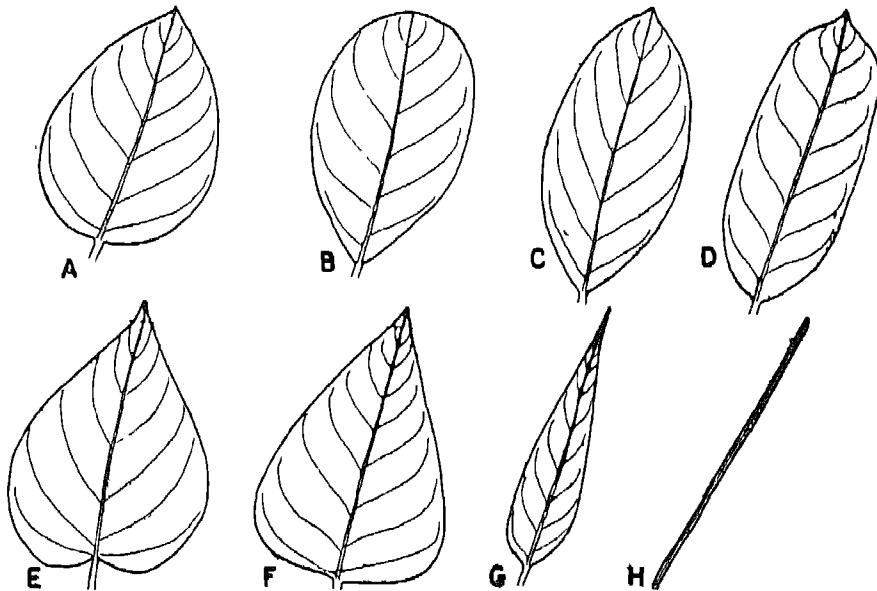


Fig. 3.4 Leaf shape

A. Ovate or egg-shaped	E. Cordate or heart-shaped
B. Obovate	F. Deltoid
C. Elliptic	G. Lanceolate
D. Oblong	H. Aciculate or needle-like

leaf but it will serve our purpose to limit ourselves here to the simpler ones. The appearance of the margin of the leaf is also fairly constant in the leaves of each kind of tree. In general the margins may be entire, that is, without any indentation or may be variously toothed or lobed. The apex or tip of the leaf is

obtuse, acute or rarely cleft as in the *Bauhinia* trees. In the *Pipal* it is drawn out into a long beak. The shape, margin and tip of leaves are best remembered by seeing them. They are set out in the accompanying illustrations (Fig. 3.4, 3.5, 3.6). The

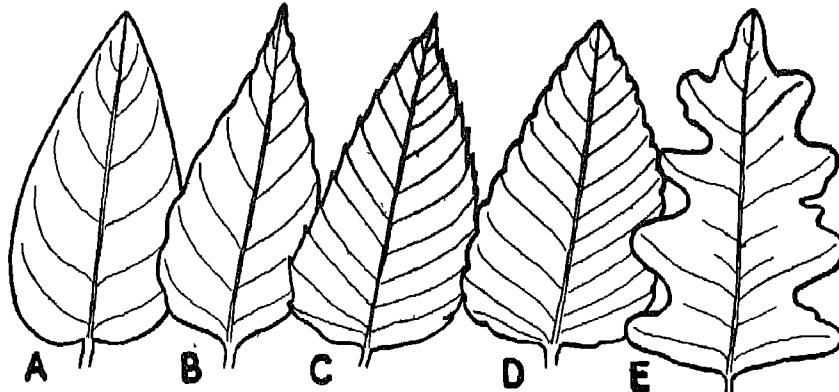


Fig. 3.5 Leaf margin

A. Entire	D. Crenate
B. Wavy or repand	E. Lobed or sinuate
C. Serrate	

terms that appear therein apply equally well to simple leaves as well as to the leaflets of compound leaves.

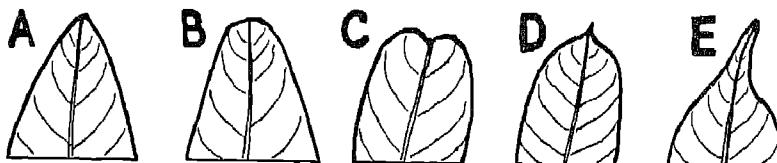


Fig 3.6 Leaf apex

A. Acute	D. Apiculate
B. Obtuse	E. Acuminate
C. Notched	

The arrangement of leaves on the twig can sometimes be of assistance in identifying a tree. There are three types of leaf arrangement as shown in Fig. 3.7. In the alternate type

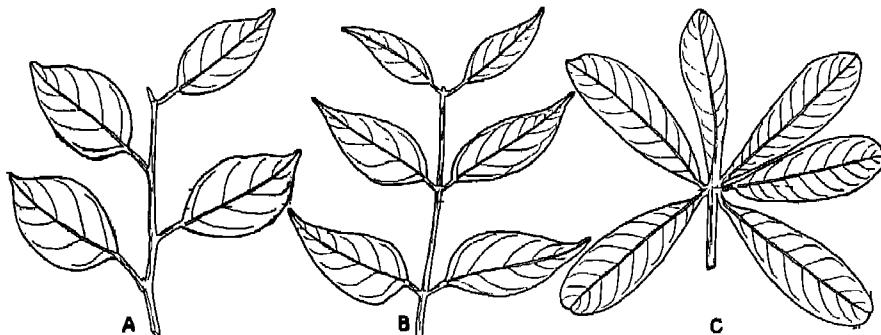


Fig. 3.7 Leaf arrangement

A. Alternate

B. Opposite

C. Whorled

which is the one most commonly met with, the leaves occur singly, attached at different heights around the circumference of the twig or attached first one to one side of it, then one to the other and so on. Examples of the alternate arrangement are found in the *Pipal*, the Banyan and a large number of other trees. In the opposite arrangement the leaves arise in pairs each attached to the twig opposite another leaf at the same level. This is typical of the Teak and some other trees. The least common of all is the whorled pattern in which three or more leaves are attached to the stem at the same level. Of this type the Scholar's tree is an example. In the Conifers a useful character to note is whether the needles are borne singly (Spruce) or in clusters (Pine, Larch, etc.).

The leaf, whether simple or compound, usually has a distinct

stalk known as the *petiole* by which it is attached to the twig. Only rarely is a petiole wanting. Below where the stalk is attached to the twig some trees bear a single or paired usually small structures known as the *stipule*. The stipule may be absent or it may be cast away early as the leaf unfolds as in the Fig and many other trees of the Mulberry family. However, in some cases the stipules may persist and in a few they are modified into straight or curved thorns as is usual in Acacias and the Indian Jujube. In the Coffee and Cinchona family to which also belong our Kadam, Haldū, Kāim, etc., the stipules are located between the petiole bases of the opposite leaves, and are described as *interpetiolar*.

The arrangement of the veins in a leaf or leaflet can also sometimes afford clues for identification of trees. Most often there

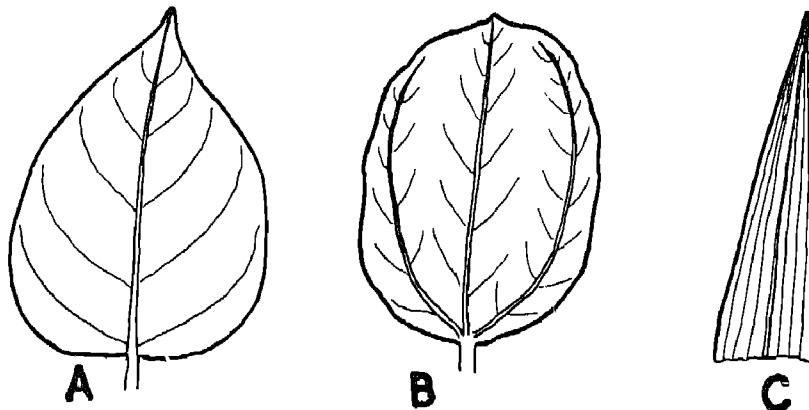


Fig. 38 Leaf venation

- A. Reticulate, 1-ribbed or unicostate
- B. Reticulate, 3-ribbed or multicostate
- C. Parallel

is only a single main rib running along the middle of a leaf and from this midrib arise the secondary nerves (Fig. 3.8A). Sometimes three main ribs are prominent (Fig. 3.8B) as in the leaf of the Indian Jujube and Cinnamon. In Bamboos as indeed in all grasses, the secondary nerves run parallel to the midrib (Fig. 3.8C).

The actual size of a leaf by itself is not a very reliable guide to the recognition of trees. Leaves of well-nourished growth are sometimes four or five times larger than the leaves of mature trees of the same species. Size also varies with the age of the leaf, and its degree of exposure to the wind and the sun. Among the cone-bearing trees the size of the leaves is a more constant feature and therefore can be used as an aid to identification; many of the Pines can be tagged by the length of their needles.

The leaves of some trees contain glands. A common type is the translucent dot found in such leaves as those of the Orange, the Bael, the *Jamun* or the Eucalypt. Such glands are best seen by holding the leaf against light. Leaves and twigs of the *Pipal*, the Banyan and others contain a milky juice known as latex.

Features of the Bark

The appearance of the bark of trees can be a useful guide to their recognition specially at a time when they are completely leafless as the deciduous trees. Another circumstance when this feature comes in handy is when you are exploring a high forest

where the foliage and flowers of many trees may be out of your sight let alone out of your reach.

The trunk of young trees and the younger branches of old trees of different species are not usually marked in a special way as to aid recognition. Many of them have a grey or brown smooth bark. But as the tree grows older many tell-tale marks show up on the bark and these are worth remembering.

A few trees retain a smooth firm bark even when they mature. The yellowish bark of the White Siris or the grey bark of the Black Siris are easy to spot in the forest. Then there are those trees whose bark is furrowed and ridged in a definite pattern. Such is the bark of the *Sal* and the *Shisham*. In the older trees of Chir Pine the bark is broken into a beautiful pattern of rectangular plates and scaly sections. The Eucalypts have their bark shredded and torn into strips underneath whose cover the light coloured inner bark is so smooth and inviting to write upon.

The bark of many trees is not easy to describe exactly but once you have become familiar with its appearance you will have little difficulty in spotting it out.

Flowers and Fruits as Identification Marks

Flowers are easy to recognize from leaves as such because they usually have brightly coloured petals which attract attention. Many of our trees owe their great beauty to their flowers. Botanists who make a study of identifying plants accurately for research purposes usually look for flowers or other reproductive structures like cones as undisputed evidence for the identification of the plant with which they are dealing.

Unfortunately, reproductive organs are frequently absent, or hard to reach in the case of tall trees. Further, for the young naturalist they present the added drawback of being more difficult to understand. Therefore, let us be contented here in knowing only a few obvious features of the flowers of different trees in a very general way.

The flowers of some trees are borne singly on the twigs such as the large ones of the Red, White and Yellow Silk Cotton trees or those of the Champak. They are said to be *solitary* (Fig. 3.9a). In the *Babul* and other *Acacias*, in the *Kadam*, the *Haldū* and the *Kaim* the small flowers appear very conspicuous on account of being clustered into round *Heads* (Fig. 3.9b). In the Indian Mesquite in the Cutch area and some other trees they arise close together in a shorter or longer bunch known as *Spikes* (Fig. 3.9c). In the Willows and the Mulberry such spike-like clusters are known as *Catkins*. In the Indian Laburnum the flowers arise distantly arranged on a long axis, the youngest at its tip, the successively older further back. Such a flower cluster is known as *Raceme* (Fig. 3.9d).

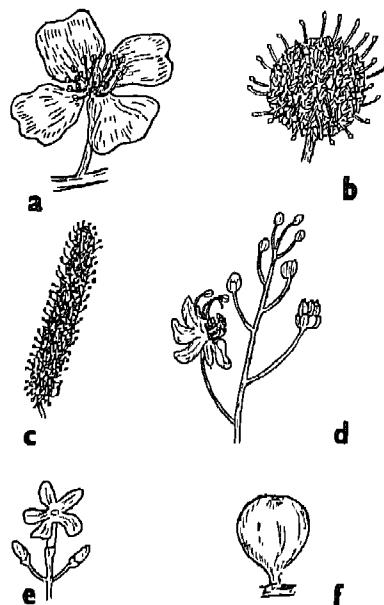


Fig. 3.9 Flower arrangement on the tree

a. Solitary	d. Raceme
b. Head	e. Cyme
c. Spike	f. Syconium

Racemes of some trees can be compound. Another main kind where the terminal flower is the oldest and the lateral the younger is known as *Cyme* (Fig. 3.9e). The very small flowers of the Mango tree arise close together on a much divided pyramidal system of branches. In all the Fig trees innumerable minute flowers occur concealed in a fleshy cup or flask-like structure called *Syconium* that can easily be mistaken for a fruit (Fig. 3.9f).

Trees of the Pea sub-family are readily recognizable because of their distinctive appearance. They have unequal-sized petals two of them forming a boat-like keel, the two side ones spreading like wings and the largest upper one raised prominently like a flag. The Flame of the Forest, the Coral tree, the *Shisham* and other trees possess this kind of flowers. Flowers of the Indian Gooseberry family are unisexual and usually without petals. This is also true of the Mulberry family. In the Willows the unisexual flowers lack both petals and sepals, consisting only of either the stamens or pistil, the organs essential for reproduction.

In all Conifers, the cones are very satisfactory recognition features because their variation in size, shape and the nature of the cone scales indicate the different species. They vary in size from the inch-long cones of the Hemlock and the Cypress to the large woody cones of the Chir and the Kail pines.

Fruit characters are often helpful in recognizing trees particularly when no flowers and leaves are available. Wind-dispersed fruits are usually of unattractive brown or grey colour. Some of them have special structures to enable them to be carried over a considerable distance and thus give their enclosed

seeds a chance of germinating in the new territory. In some trees it is the seeds, not the fruits themselves, that are thus provided and which serve the same purpose. Fruits adapted for dispersal by birds and mammals are as a rule brightly coloured and fleshy. The animals eat them and the seeds are either cast away or voided after passing through their guts unharmed.

In Sal and Dipterocarp fruits the sepals persist around the fruit and grow into wing-like expanses like a shuttlecock and this is helpful in dispersal. The teak has a bladdery calyx enclosing its fruit and serving a similar purpose.

The pod is a distinctive kind of fruit met with in many of our trees like the *Babul*, the Tamarind and the *Bauhinia*. It is usually an elongated and flattened fruit with seeds arranged in a single file within. Pods of the Indian Laburnum and pink Cassias, however, are cylindrical, not flattened.

The Names of Trees

In almost every language of the world there is a name given to each of the more common or useful trees of the neighbourhood. In the plant science of botany also each known kind of tree is given a scientific or botanical name. These names are usually in Latin or are latinized versions when derived from other non-Latin languages. Many of our common trees have not one but several common names given to them as is to be expected in a vast multilingual country such as ours where a variety of languages and dialects are in use in different states and regions. To mention just one example, the is known as *Aamra* in Sanskrit, *Aam* in Hindi, *Amra* and *A*

in Marathi, *Ambo* in Oriya, *Maa* in Tamil, *Maamidi* in Telugu and *Maavu* in Kannada. However, botanists no matter which part of our country or the world they are in, call the Mango by only one scientific name which is *Mangifera indica*. Incidentally it will be of interest to know that the Latin name *Mangifera* is originally derived from the Tamil word *Manga* for the unripe fruit of this tree. The advantage of the scientific name is that according to internationally agreed rules there is only one valid name for each kind of tree or plant. Therefore, if we wish to be accurate, scientific names must be used because when you refer to a tree or plant by such a name you do not leave any room for doubt as to what kind of a plant you are referring to, describing or studying, no matter in whichever part of the world. It is for this very reason that while describing the several trees in the subsequent chapters of this book, their scientific names are also mentioned alongside in parenthesis and in italics.

The scientific naming of trees and indeed for that matter of all plants as well as animals, is a very methodical matter. Each kind of tree, plant or animal has in fact a double name given to it. Thus in *Mangifera indica*, "Mangifera" refers to the group of mangoes generally and "indica" to the particular kind of Indian mango with which all of us are familiar in this country. Again, in *Ficus religiosa*, "Ficus" refers to the fig group and "religiosa" to the particular kind of fig tree, in this case the *Pipal*. Another kind of fig such as the Banyan is *Ficus benghalensis* and the edible cultivated fig is *Ficus carica*. Thus *Mangifera* and *Ficus* are group names each referring to a genus (plural genera) which is technically a group of related species. Thus all of us humans of today are one species called "sapiens"

of the genus "Homo" to which also belonged other species of pre-historic man such as *Homo neanderthalensis*.

Classification of Trees

Botanically, all trees (and other plants, shrubs, herbs and climbers as well) are grouped into two broad categories. One includes all those plants which reproduce by cones and uncovered seeds, that is, the seed is *not* surrounded by a fruit. They are known as Gymnosperms. Most of the trees in this category possess needle-like or scale-like leaves. The other category includes all those plants which reproduce by some kind of flower and by seeds embedded in fruits. They are known as Angiosperms. Most of the trees in this category have broad thin leaves. Once upon a time, in the remote past of our earth's history, the Gymnosperms held sway. But in the world of today the Angiosperms far outnumber the Gymnosperms in the variety of their species. They are thus regarded the dominant group of plants of today. They are also the principal source of our daily food.

The two above-mentioned categories—the Gymnosperms and the Angiosperms—are further subdivided into classes, orders and families by botanists who make a special study of classifying plants. In botanical language, family refers to a group of related genera with their species. For example, the family Pinaceae among the gymnosperms includes within its fold all the pines. The great Grass family, Gramineae, includes some of the most useful plants such as Wheat, Rice, Corn and other cereals and millets, and among trees the Bamboos as well, which

are in fact giant grasses. The Leguminoseae, another large family, includes all our pulses, several forage plants and trees like the Tamarind.

How to Preserve Tree Specimens

If you are one of those keenly interested in trees then you will find it useful to preserve parts of them to serve as records for future reference. Thus, for example, you may come across an unfamiliar tree which for one reason or another you are unable to identify on the spot. Therefore, if you can collect a leaf and a flower-bearing twig of it and preserve it in the way described hereon, a good botanist can identify it for you at any future date when you have an opportunity to consult one. Only remember that while the shape, arrangement and other features of the preserved leaves are quite helpful for identification they alone are insufficient for correct and convincing identification except perhaps in the case of very common and familiar trees. It is always good to have the flowers and if available the fruits as well, on or along the leaf-bearing twig that you collect for preservation. It is necessary to note the date and place of collection of every specimen that you preserve because many trees occur in preferred areas and habitats which also often offer useful clues for identification.

Plants (unlike most animals) for identification purposes are easily preserved in a dry form without the need of bulky containers and preservative fluids. This is simply done by pressing a convenient sized specimen between the folds of a newspaper or blotting paper or the pages of a large-sized

magazine such as an old 'Illustrated Weekly of India'. Leaves too large for the final mounting sheets must be pressed in sections. Large bulky fruits, bark, etc., may be sectioned before they are pressed or dried and kept separately. While pressing, it is a good idea to put a few leaves upside down and to cut through some of the flowers especially if they happen to be of the tubular type concealing the essential organs within the tube.

Having carefully selected a suitable twig, lay it out flat on the paper and fold the sheet or leaf of the book. Put two or three empty sheets between each sheet containing a specimen so as to form a flatten and more absorbent bed. When all the specimens have been pressed in this way put the bundle between two hardboards of the proper size and put it away in a corner with a heavy weight on top, or strap the boards tightly together. The use of a weight is preferable as it presses down constantly as the specimens flatten in course of drying. The strap would have to be tightened periodically. The papers must be changed every day or so according to the relative dryness or humidity of the prevailing weather and the fleshiness of the specimens and again put back under the weight for a further period of pressing. The process of changing the paper must be repeated till the specimens are quite dry. The first changing of the paper gives the worker an opportunity of rearranging the specimens which are still wet and amenable without breaking, to straightening out unnecessary folds and overlapping that may have come about in the first pressing. The drying process may be hastened by more frequent changes of the sheets or by putting the bundle in the sun sideways or into an oven which should not be too hot. If it is very hot then the specimens become too brittle or

curl badly. A moderately hot iron can also be used to press out unwanted folds as well as for hastening the drying process.

Every specimen should be suitably labelled, a rough label being used at the time of pressing, giving the locality, date, colour of the flower or any other character that may strike the collector at the time of collection. Utmost care should be taken to see that the labels of different specimens are not interchanged while the sheets are changed in the plant press. Such confusion can be avoided by tying the label on to the specimen and noting the details on these and not on the sheets used for pressing. A serial numbering system can also be followed, the numbers being attached firmly to each specimen and coordinate data maintained in a separate notebook or diary against each numbered specimen. A specimen without a proper label is worthless for any purpose and much less so for cattle to browse on.

No doubt plant specimens lose much of their natural beauty and colour that they may possess, on being pressed and dried. But the object is not to preserve their beauty but to preserve them for future identification and reference.

A serious collector of specimens may resort to poisoning his specimens with corrosive sublimate (Mercuric chloride) either by painting them with or dipping them in a saturated alcoholic solution of this poisonous chemical. The alcohol quickly evaporates leaving the specimens coated with a thin layer of the poison which should be kept out of reach of children or novices. The idea of poisoning is to prevent the specimens from being attacked by molds.

After being dried and poisoned the specimens can be kept

either loose in a clean sheet of paper or it may better be mounted on a stiff paper or white cardboard of a uniform size. The standard professional size of these mounting sheets is 44.5 by 29.3 centimetres. If feasible the sheets could be bound together into an album. The specimens are wholly gummed to the mounting sheet, fixed down with gummed strips or stitched on to the sheets by thread and needle. A final label is then neatly copied in ink from the rough label tied earlier to each specimen or noted against its number in the notebook. This is fixed on the right-hand bottom corner of the mounting sheet. The specimens are suitably arranged one above the other and stored in a suitable box or cupboard. Napthalene moth balls or some other insecticide must be included in the cabinet to keep off insects.

Common Native Broadleaved Trees

HAVING learnt something of the life of trees, their appearance and structure, let us get introduced to some of our more common native trees, first to those bearing simple leaves and then to those with compound leaves.

Trees with Simple Leaves

MANGO (*Mangifera indica*, Fig. 4.1) is familiar to every Indian and the best varieties of this most delicious of all fruits have been evolved in our own country where this tree has been cultivated for more than 2,000 years. We are told that



Fig. 41 Mango

Aamrapali, the celebrated courtesan of the Buddha's time, was, as an infant, picked up abandoned in a mango grove and thus her name was derived from *Aamra* which means mango in

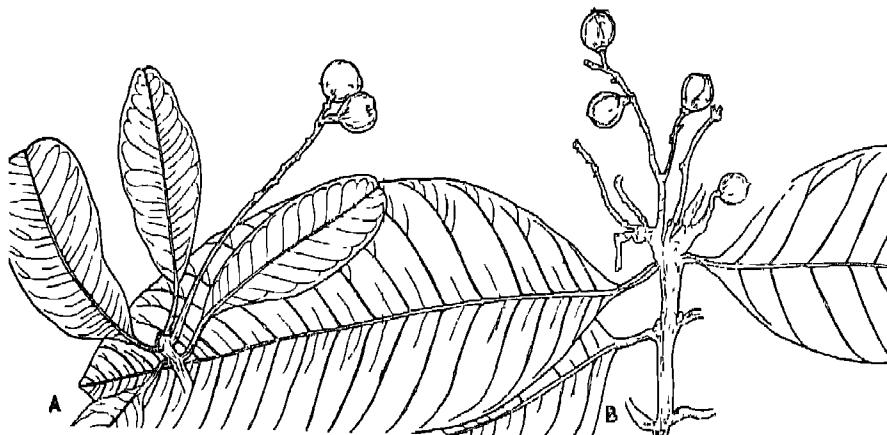
Sanskrit. It is said that the Buddha was also presented with a grove of this tree under which he could find repose. More than a thousand varieties of mango exist but only about twenty are most popular for the best quality of fruit that they yield. Alfonso, *Banganapalli*, *Chausa*, *Dusehri*, *Kalmi*, *Langra*, *Malgova*, *Raspuri* are some of the best known of these. A lot of regional patriotism exists in the appreciation of the above-mentioned varieties. Thus, for example, to the Bombaywallah Alfonso is the best, the Lucknowwallah swears by his *Dusehri* whereas to the Kashiwallah there is nothing like his *Langra*. However, to the unprejudiced mind all these varieties are superb, each in its own way for its distinctive qualities of taste and flavour.

The Mango tree is usually found planted near villages, in groves or *topes* and in homes. It is an evergreen tree that casts a cool shade all the year round. The bark is rough, thick and dark in colour. The simple leaves are crowded at the ends of the branches. They are leathery, smooth and shiny with curved secondary nerves springing from the midrib. They give a distinctive smell when crushed. Young leaves are coppery-red. The tree flowers and bears fruit earlier in the South than in the North. During the season the small, fragrant flowers appear in long pyramidal clusters projecting beyond the leaves. They are greenish-yellow in colour and of the thousands that bloom on a tree only a few perfect ones ultimately produce fruit. The rest drop off. The fruit is usually oblique in outline with or without a beak on one side near the lower end. It takes $2\frac{1}{2}$ —3 months to ripen. Each fruit has skin, thick juicy flesh that forms the edible part of the fruit and a tough fibrous kernel that encloses the real seed within. There is a great variation

in the size, shape, colour, taste and flavour of the fruit in the innumerable varieties known under cultivation. The best varieties of cultivated mangoes are propagated by inarching and grafting. Although the cultivated trees do not attain the magnificent size of the wild ones, their fruit is far superior.

Ripe mangoes are eaten as such while unripe and inferior ones are made into chutneys, pickles, preserves and so on. Twigs are used as toothbrush and leaves to festoon doorways and rooms during marriages and on other ceremonial and festive occasions. They are also used as spoons for the pouring of holy libations. The Mango wood is soft and not durable but is nevertheless widely used because it is cheap. It is suited for planking, packing cases and tea chests. The wood is also held sacred and is included in funeral pyres. The juice of unripe mangoes can cause blisters on tender skins.

CUDDAPAH ALMOND (*Buchanania angustifolia*, Fig. 4.2A)



occurs in the dry deciduous forests of South India, especially the Cuddapah district of Andhra Pradesh. Like mango it has simple leaves which are however deciduous. Its oblique one-seeded nuts are roasted and eaten like Cashew nut or Almond. A close relative Chironji (*Buchanania lanza*, Fig. 4.2B) occurs widely in the deciduous forests both in North and South India. Though edible, its nuts are inferior to those of the Cuddapah almond. Its wood is used for bullock yokes, boxes, etc.

DHOBY NUT or MARKING NUT TREE (*Semecarpus anacardium*, Fig. 4.3), another relative of the Mango and the Cashew, is so called because from the black corrosive juice of its fruit is made the indelible ink that our *dhobies* use to put their identification marks on clothes given for wash. The tree is found widely in our forests. It has large simple leaves, obovate in shape. The black oblique fruit is seated on a fleshy orange-coloured receptacle, the latter recalling that of the Cashew

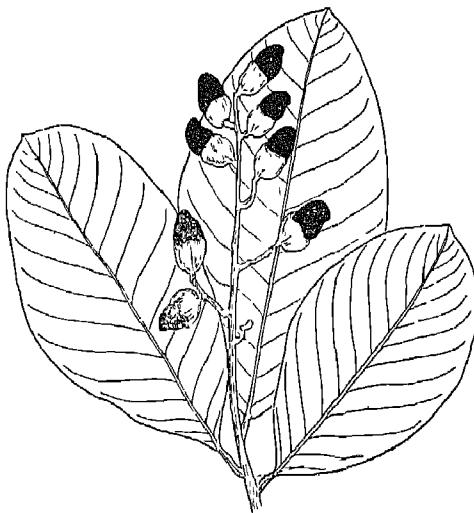


Fig. 4.3 Dhoby Nut

tree and being eaten when ripe. The black upper part which is the real fruit is used for dyeing and in indigenous medicine. Its kernels are roasted and eaten.

Fig trees of many kinds abound in our country. Two of the



Fig 4.4 Pipal on Palm

most familiar of these are the *Pipal* and the Banyan. These and some other wild fig trees often begin their life as epiphytes, that is, as plants growing upon other plants and not directly in the ground. Birds feeding on their fruits drop or void the seeds in the angles between the leaf bases of the Wild Date or the Palmyra palm. There they germinate and the roots gradually extend towards the soil. In the course of time the roots embrace the supporting palm except its upper part in a tight clasp so much so that the top of the palm will seem to be issuing from the trunk of the Fig tree (Fig. 4.4). The religious consider this as a holy marriage instituted by providence! Eventually the palm or the other supporting tree is shaded out or slowly strangled and killed and the Fig continues to grow into a venerable age.

PIPAL, BODHI or BO TREE (*Ficus religiosa*, Fig. 4.5A) of the Buddhists is noted for the veneration it commands by both the Hindus and the Buddhists alike. While the Hindus associate the tree with *Trimurti* and worship it, to the Buddhists the tree is sacred because the Buddha meditated and found enlightenment under a *Bo* tree. A sapling of this original tree in Bodh-Gaya was taken to Ceylon (now Sri Lanka) by Mahinda, son of emperor Asoka; it or its descendant still lives and flourishes there even to this day. Like its close fig relative the Banyan, the *Pipal* also usually starts life on the Palm or other trees; often on the walls of neglected buildings, temples or forts where the seeds ejected by some bird may have come to rest. If it is not removed in time its roots penetrate the masonry and may eventually bring the building or wall into complete ruin. The tree is often planted near villages and temples for worship. The trunk is usually fluted in old trees, the bark

is smooth and pale grey. The *Pipal* leaves are long-stalked, heart-shaped and terminate in a long tapering point. They are shiny green in colour and flutter and dance in the slightest

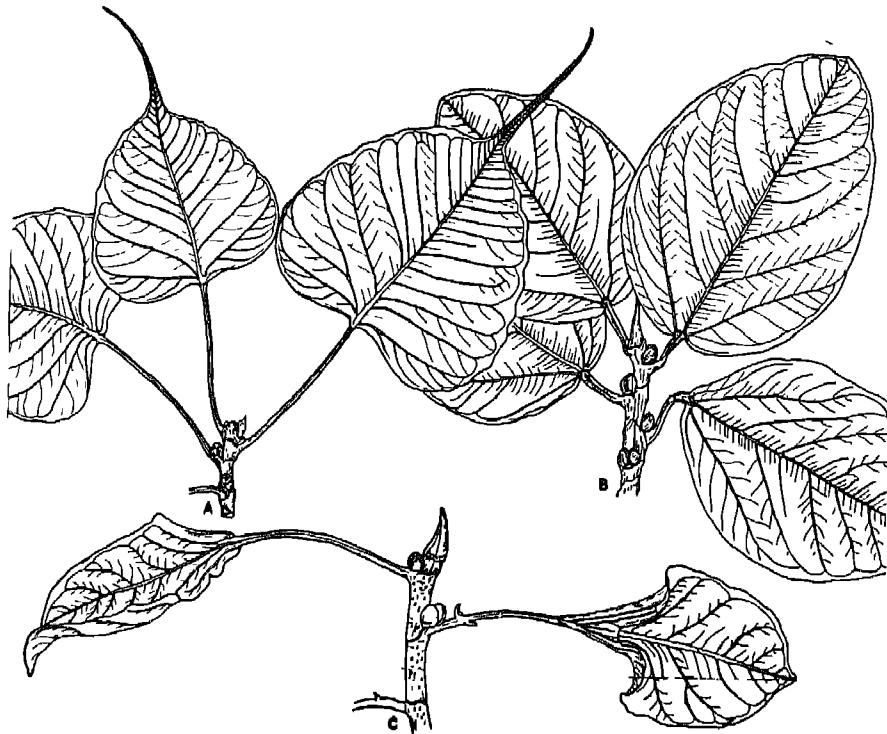


Fig. 4.5 A. Pipal

B. Banyan

C. Krishna Fig

breeze. The shiny red new foliage is an especially charming sight. As in the Banyan, the figs arise in pairs in the angles of the lower leaves on the twigs or above the scars of the fallen leaves. They have more or less the same structure and show the same interesting mode of pollination described under the Banyan. Worship apart, the *Pipal* has a few medicinal or economic uses.

The well-pressed and dried leaves can be nicely painted upon. In the forest they are lopped for feeding goats, buffaloes, elephants and camels.

In the traditional folklore of India, the *Pipal* is considered as the female to the Banyan.

BANYAN TREE (*Ficus benghalensis*, Fig. 4.5B) can grow to a venerable old age with a spreading evergreen crown supported by numerous pillar roots and looking like a vaulted canopy. The trunk is never quite cylindrical because it is composed of several amalgamated aerial roots. From the spreading side branches hang clumps of brown aerial roots that eventually unite and on reaching the ground take root and grow into separate pillars, supporting the crown. In very old trees the original main trunk slowly disintegrates leaving behind the crown entirely supported by the older trunk-like root pillars. This is what has happened with the famous old Banyan in the Indian Botanical Garden at Sibpur, Calcutta. It has a vast crown, 377 metres in circumference, and well supported by more than a thousand root pillars. There are many other centuries-old Banyans in various parts of our country. There is one in Madurai and another near Adyar in Madras and a third in Sri Lanka as already mentioned. In the South many country roads are lined with Banyans. The leaves are large, leathery, mostly elliptical in shape, dark glossy green in colour and conspicuously pale-veined. Like nearly all Fig trees, the Banyan has two large stipular scales which cover the leaf bud. As the leaf develops the scales fall off leaving a ring around the stem at the base of the leaf stalk. Young leaves have an attractive reddish tinge. Like the *Pipal*, the Banyan appears to bear no

flowers but only fruit. Actually what looks like a fruit right from the beginning is actually a fleshy cup concealing numerous minute male and female flowers commonly referred to as the Fig. Figs of the Banyan are stalkless and grow in pairs in the leaf angles. They contain not only the minute flowers but a host of minute 'fig insects', a wasp. Each species of fig usually has its own species of fig wasp attached to it. The wasp cannot live without the fig, and the Fig trees cannot produce seed without the wasp. The insects enter through a hole in the top of the fig and lay eggs in some of the flowers which are known as the gall flowers. The eggs hatch and mature into new insects which on leaving their home become dusted with pollen from the male flowers. They then make their way into another fig and repeat the process thus ensuring pollination of the other functional female flowers. Figs of the Banyan become bright red when they ripen and are much sought after by birds and bats which account for the dispersal of the seeds in them. Monkeys are also very fond of them.

The Banyan is held sacred by the Hindus and hence is not usually cut by them. They sometimes protect the root pillars by enclosing them in split bamboo culms. The tree is widely planted for shade and its leaves are used as fodder. Coarse fibre can be made out of the bark and the young hanging roots. The wood is neither good as timber nor as fuel. The leaves are stitched into plates.

KRISHNA FIG (*Ficus krishnae*, Fig. 4.5C) is an unusual variant of the Banyan. Its leaves which are smaller than those of the Banyan have a pocket-like pouch on their back at the base

above the leaf stalk. The religious persons believe that this is because Lord Krishna used them to scoop out butter.

PAKAR (*Ficus lucescens*, Fig. 4.6A) occurs commonly along roadsides and in villages. Its leaves somewhat resemble those of

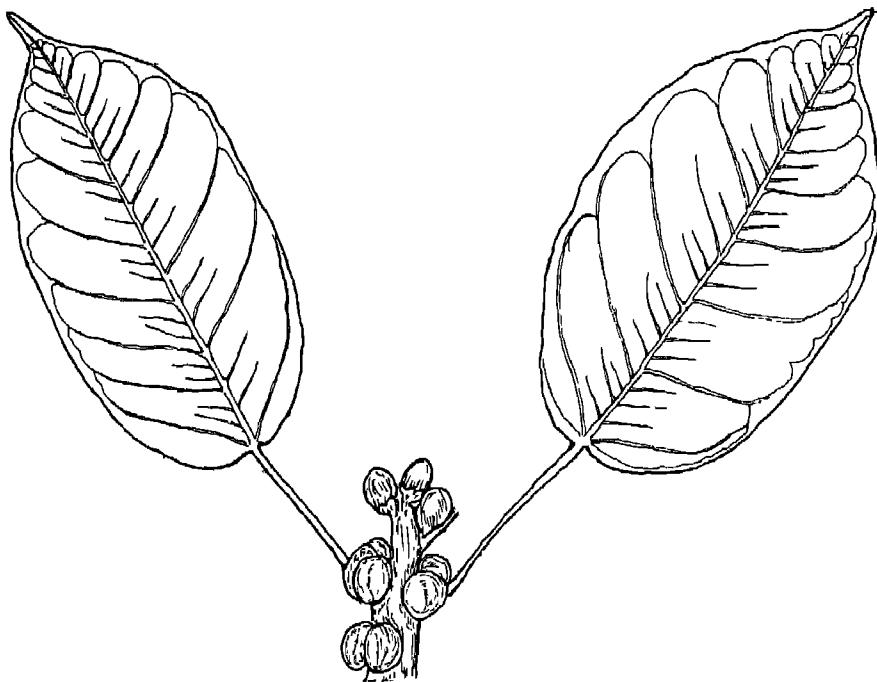


Fig. 4.6 A. Pakar

the *Pipal* in general appearance but are elliptical in shape with a very short tip. Its foliage is lopped for fodder. The bark yields a fibre out of which ropes are made.

GULAR (*Ficus racemosa*, Fig. 4.6B) in Hindi, *Udumbara* in Sanskrit and *Atthi* in Tamil and Kannada all refer to one and

the same species of the wild Fig tree. It has no aerial roots but is typically cauliflorous, that is, figs are borne in bunches along the stem and main branches of the tree, and not on the twigs as



Fig. 4.6 B Gular

is usual. Its unripe fruit is eaten cooked and the ripe one as such, tasting like the cultivated fig. The leaves provide fodder.

THE JAVA or BENJAMIN FIG TREE (*Ficus benjamina*, Fig. 4.7A) has small shiny leaves and the fruit is orange-yellow when ripe. It is much liked by crows. In Bangalore there is a stately avenue of Fig trees and in them nest innumerable crows. Like our own *Pipal* this Fig tree has wrought havoc with

the ancient Hindu temples in Java and Cambodia.

INDIA or ASSAM RUBBER TREE (*Ficus elastica*, Fig. 4.7B) with its serpentine buttresses and abundant latex is common in Assam and Bengal, but rubber made out of its latex is inferior to that obtained from the Para Rubber tree.

CULTIVATED FIG (*Ficus carica*) is a native of the Mediterranean region where it has been grown since ancient times for its edible fruit. It finds mention in the Old Testament of the Bible. The best figs are still grown in and exported from that part of the world. To a certain extent fig is also cultivated in India but the familiar sundried figs pressed flat and strung into garlands which are sold in our dry fruit markets, are mostly imported from abroad.

JACK (*Artocarpus heterophyllus*, Fig. 4.8A) also belongs to the Fig family. It occurs wild in the evergreen forests of the Western Ghats but is widely cultivated in the warmer regions of our country for its edible fruit which is one of the largest

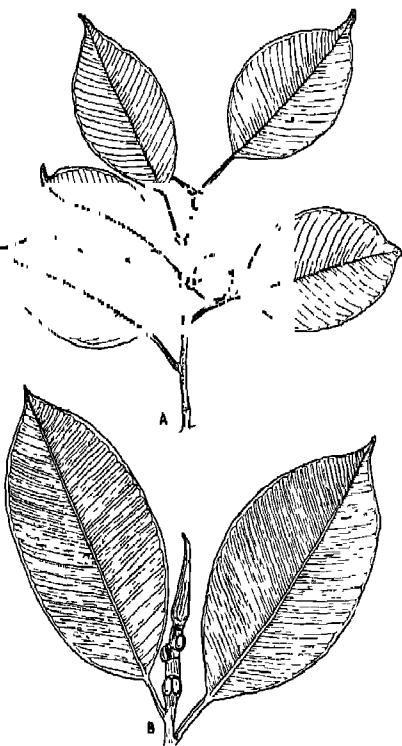


Fig. 4.7 A. Java Fig
B. India Rubber

in the plant world. The tree is evergreen with a dense crown of simple, alternate, thick, leathery dark-green leaves. An unusual feature of the tree is that it bears its huge fruit hanging from the older woody branches, main trunk and sometimes even on the exposed roots of the older trees. Each fruit develops from an entire cylindrical cluster of female flowers, the



Fig. 48 The Jack group of trees

- A Jack
- B Monkey Jack
- C Chaplash
- D Wild Jack

male clusters dropping off after shedding their pollen. The enormous fruit is irregularly oblong or round, sometimes weighing as much as a hundred pounds. It has a thick and rough skin covered on the outside with numberless conical studs. When immature they are green, later becoming more yellowish and eventually brown. An experienced person can tell whether a Jack fruit is ripe or not just by tapping it with the fingers but soon there is the telltale fruity smell. Even the ripe fruit is very sticky, when cut, due to the latex that its core and thick skin contains. Therefore, it is usual to smear the knife and one's fingers with oil to allay this stickiness. Inside the compound fruit there are numerous small cavities, each containing one seed, invested in the yellowish pulpy edible sheath. It is eaten fresh or dried, but large quantities are indigestible and can cause diarrhoea. People in north-west India are however usually unfamiliar with the ripe fruit-bearing varieties. They would have seen and eaten only the unripe cooking variety which is consumed only as vegetable. The seeds can also be eaten variously cooked or roasted. Jackwood is yellow in colour and much used in the South for doors, windows, furniture, musical instruments like the Veena, etc. An extract from the heart-wood is used for dyeing the saffron robes of priests especially in Burma and the Nambudri Brahmins of Kerala use the dry branches of this tree to produce by friction the sacred fire. The name Jack is from the Sanskrit *tchackka* or the Malayalam *tsjaka*.

A number of close relatives of the Jack are valuable for their fruit (which has similar structure but much smaller in size) and timber. The Monkey Jack or *Lakuch* (*Artocarpus lakoocha*,

Fig. 4.8B) yields both edible fruit and commercial timber, the Chaplash (*Artocarpus chaplasha*, Fig. 4.8C) and the Wild Jack or Aini (*Artocarpus hirsuta*, Fig. 4.8D) only timber. The Bread-fruit tree which is cultivated for its fruit in South India is described in Chapter 7.

MULBERRY TREE (*Morus species*, Fig. 4.9) also belongs to the Fig and Jack family. It is often cultivated either for its edible fruit or for its leaves which form the principal food of the silkworm. It grows to the size of a small or medium-sized tree and is leafless during the cold weather. The leaves are simple but very variable in shape even on the same twig. The male and female flowers are borne on the same or on separate trees. They arise in catkins, the entire female catkin with its axis and sepals of its flowers becoming succulent and ripening

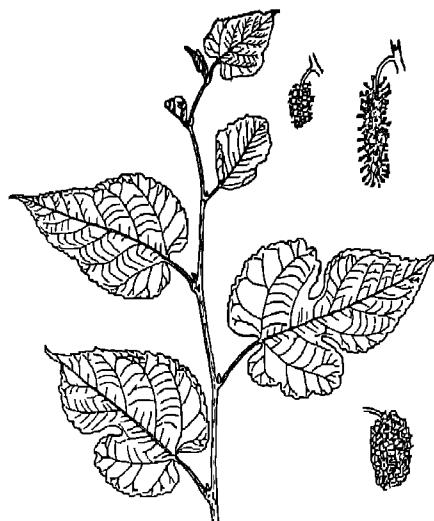


Fig. 49 Mullberry

into a fleshy edible mass of fruit. Besides their useful leaves and edible fruit, the mulberry wood finds several uses. It is light coloured and takes a fine polish on which account it is a good substitute for Ash and is used for tool handles, bent wood frames of badminton and cheap tennis rackets, hockey sticks, cricket stumps, etc. It is also used for agricultural implements and the shafts of tongas. Branchlets are used in basketry and the bark yields a rough fibre. The

fruit of the White Mulberry is edible but is not of as good a quality as that of the Black Mulberry which has violet coloured fruit.

UPAS TREE (*Antiaris toxicaria*), also of the same family as the foregoing, is the largest of the South Indian trees and is found in the evergreen forests of the Western Ghats. Its milky juice is more or less toxic.

JAMUN or JAMOON TREE (*Syzygium cumini*, Fig. 4.10) is one of our common evergreen trees. It occurs wild in our forests and is often planted for shade and for its rich purple-black astringent fruit much liked by children. The tree when well grown has sweeping branches and large dark-green smooth and shiny close-veined opposite leaves dotted with translucent dots visible only when they are held against bright light. The bark is fairly smooth, light and dark-grey in pattern. Where it has peeled off there are left shallow depressions. The flowers are whitish but inconspicuous being rather small in size and partly hidden below the green foliage. As in the Eucalypts to which the tree is related, the petals are in one piece and come off as a cap when the flower opens, releasing a bunch of stamens spread over the edge of the undivided calyx cup. The fleshy oblong fruit which varies in size and palatability from tree to tree is purple-black when ripe. It is juicy, sweetish, astringent and is good to taste especially with a pinch of salt. It darkens the lips and the tongue. Tarts and puddings are also made out of it. A fermented liquor can be made out of the juice. The *Jamun* fruit is held sacred to Krishna and is therefore, often planted near Hindu temples and for shade. Its wood burns well and the leaves can be fed to tassar silkworms. The bark is useful in dyeing and tanning; it is also good as a medicine

for dysentery. From the unripe fruit also, a remedy for this complaint is decocted. The wood is variously used in villages but is specially suitable for use under water.

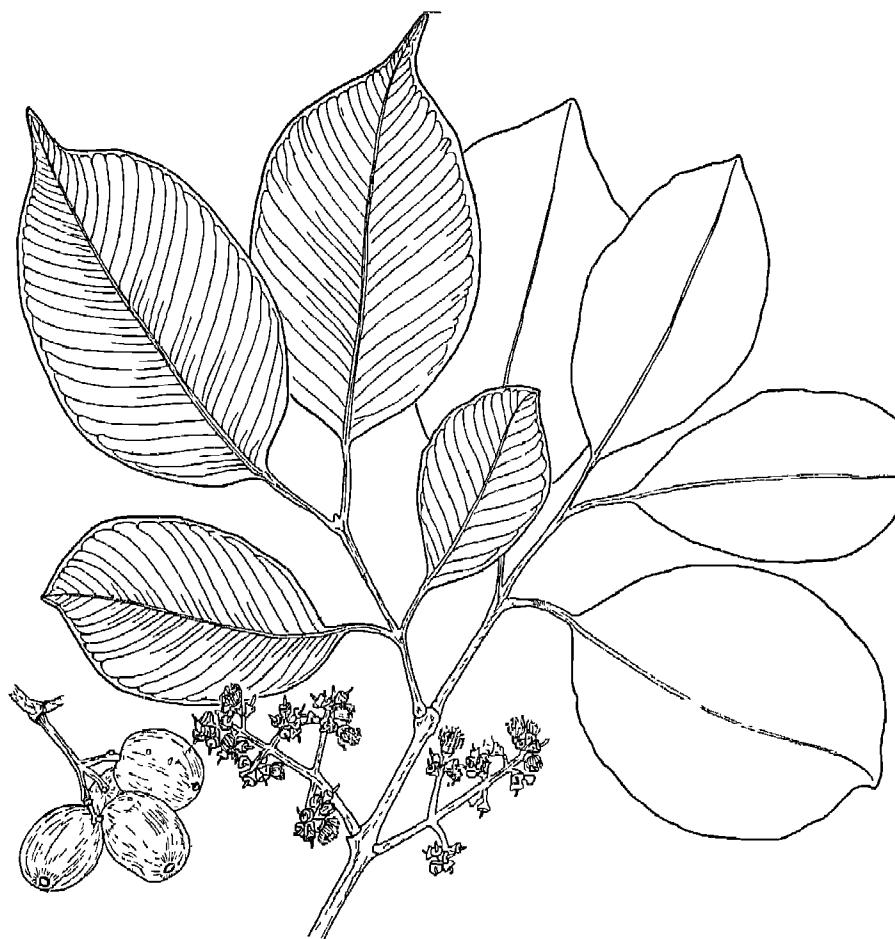


Fig. 4.10 Jamun

Botanically very close to our native *Jamun* tree is the Clove tree (*Syzygium aromaticum*), a native of the Molluccas. The well-known Clove or *Lavang* sold in our bazaars is the dried flower stalks and flower bud of this tree. The Clove is one of world's important spices and has been in use since early times in oriental countries. Although the tree is originally the native of the former Dutch East Indies, today it is Zanzibar, a little island off the east African coast which is the great exporter of this spice. The Rose Apple (*Jambosa vulgaris*) also belongs to the same family as the *Jamun* and the Clove; so also do the Guava and the Bottlebrush which trees we shall consider later in Chapter 7.

MAHUA (*Madhuca indica*, Fig. 4.11) is one of the most important of Indian forest trees not because of its timber but on account of its fleshy edible flowers. This tree occurs abundantly in Central India of whose village folk and jungle tribes it provides a most important article of food that can be stored almost indefinitely. It is a large deciduous tree of drier hilly tracts. The bark is thick, vertically cracked and wrinkled. The simple leathery leaves occur clustered near the ends of the branches. The leaf stalks when bruised exude a white milky juice. The flowers arise in close bunches of a dozen or so from the ends of the branchlets when the latter are leafless. The thick, juicy and creamy white corolla springs from a plum-coloured leathery calyx. The small petals are distinct only near the tip of the corolla tube from the distal end of which the green style protrudes like a tongue. Stamens are hidden within and can be seen only through the chinks of the tube. The tree blooms at night and by dawn the fallen corolla tubes litter the ground

below the tree and are eagerly sought by deer and bears. Bears are said to behave sometimes as drunkards when large quantities of these flowers eaten by them start fermenting in their stomachs.



Fig. 4.11 Mahua

Birds too enjoy them. The new leaves sprout while there are still flowers on the tree and their shades of rust and crimson render the tree extremely decorative. The fruit is juicy green berries, containing shiny brown seeds. During the season, gathering of the edible *Mahua* flowers is an important routine

for the tribal folk. The ground beneath the trees is cleared of grass and leaves so that the fallen corollas may be easily swept off the ground. They keep a night vigil and at dawn they sweep up the blooms and put them aside to dry. The average yield of a tree is about a quintal. The dried flowers are pressed and eaten as such like figs; they are also made into pudding and sweetmeats and eaten mixed with other food. Sugar too can be made from them. They are also fermented and distilled into a strong spirituous liquor with an unpleasant odour. But jungle tribes like it. The fruit is also eaten as vegetable or ground into meal. A thick yellowish oil is expressed from the seeds which jungle tribes use for cooking or sell for making soap and candles. The residue makes a good manure. A close relative of the *Mahua*, *Madhuca longifolia* occurs in Southern India and is put to the same uses as the *Mahua*.

ELENGI or BAKULA of the classical Sanskrit literature (*Manilkara elengi*, Fig. 4.12A) is an evergreen tree of the *Mahua* family. The simple leaves are leathery and shiny with wavy margins. The tree occurs in South India and is extensively planted elsewhere near temples, in gardens, etc., for its fragrant starlike flowers (sometimes for the fruit as well) which are held sacred by the Hindus. They string them into beautiful garlands and use these for worship. An oil is distilled from the flowers which is used as a perfume and a stimulant medicine. The wood is hard, tough and durable. It is much used for oil presses, house-building, rice pounders, in turnery, etc. The bark is used in indigenous medicine. The fruit is eaten and oil for burning extracted from the seeds. The Khirni (*Manilkara hexandra*, Fig. 4.12B), a closely related species, occurs wild in forests and

is also cultivated in parts of North India. It is put to almost identical uses as Elengi. In fact its fruit is even more palatable and is hence more commonly seen sold in the fruit markets during the hot season.

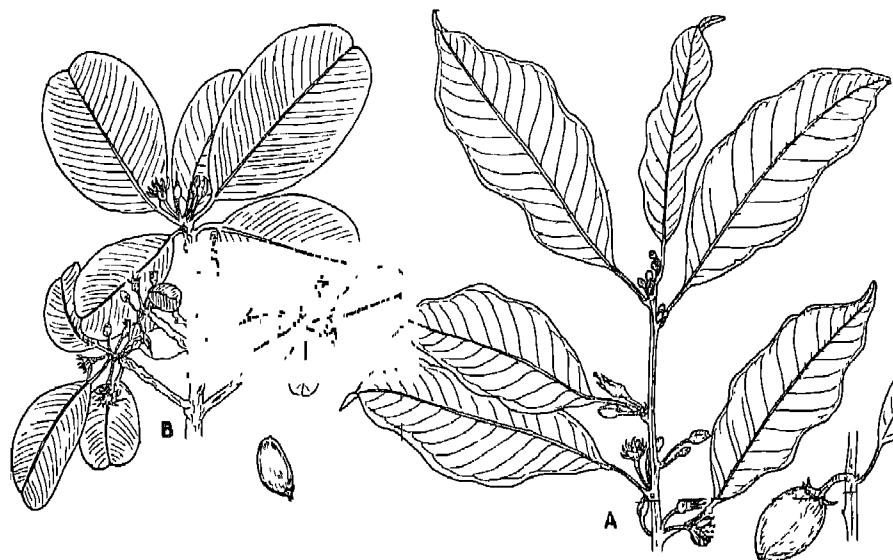


Fig 4.12 A. Elengi
B. Khirni

table and is hence more commonly seen sold in the fruit markets during the hot season.

CHAMPAK or CHAMPA (*Michelia champaca*, Fig. 4.13) is one of our best known ornamental trees grown for the sake of its sweet-smelling flowers and handsome undulate leaves. It occurs wild in many of our high forests and several varieties are known under cultivation. These differ in the size, colour and intensity of fragrance of their flowers. It is a tall evergreen tree with smooth bark. The leaves are simple and have a wavy margin. A sheath-like structure encloses the bud and falls

away when the latter blooms. Each flower has several petal-like structures enclosing a central core of numerous close fitting, short stalked stamens surmounted by a dome of numerous spirally arranged ovaries. The latter ripen into an aggregate fruit of several oblong fruitlets. When ripe, these fruitlets open



Fig. 4.13 Champak

out to reveal the red seeds which may eventually hang down suspended by fine filaments of the seed stalk. The wood known as Champ in the timber trade is put to many uses such as for furniture, planking, door panels, etc., particularly in Assam and Eastern India. It is also a good fuel. The fragrant

Champak flowers are used for worship and by women to decorate their hair. A yellow dye is extracted from the flowers by boiling. Various parts of the tree are used medicinally.

The Magnolias are close relatives of the Champak. They are found in evergreen forests of Assam and Bengal, some at higher elevations. Some American species are sometimes grown as ornamentals in our gardens. The flowers of most species are very large and ornamental and also sweetly scented.

MAST TREE, MADRAS ASHOKA or DEBDARU (*Polyalthia longifolia*, Fig. 4.14) is a tree quite different from and unrelated to the real Ashoka described elsewhere in this book, under trees with compound leaves. It belongs to the family of the Custard Apple tree whereas the real Ashoka is closely related to the Gul Mohar. The Madras Ashoka, actually a native of the Southernmost parts of India and Sri Lanka, is a tree often found planted near Hindu temples and along avenues and in parks. The tree is valued mainly for its compact symmetrical crown which is pyramidal in one variety and a lofty column in another (this latter variety is commonly seen in gardens in Madras city) with downward sweeping branchlets. Although evergreen, the tree is most attractive when its new leaves are appearing. At this time the rusty tinge of the limp new leaves, the yellow-green of the half grown leaves and the deep green of the old leaves are all in striking contrast to one another. The leaves are simple, lance-shaped, and with wavy edges. The tree flowers only for a short while and the pale green star-like flowers are so inconspicuously hidden away in the foliage that they are likely to be altogether missed by the casual observer. The fruit which is black when ripe is

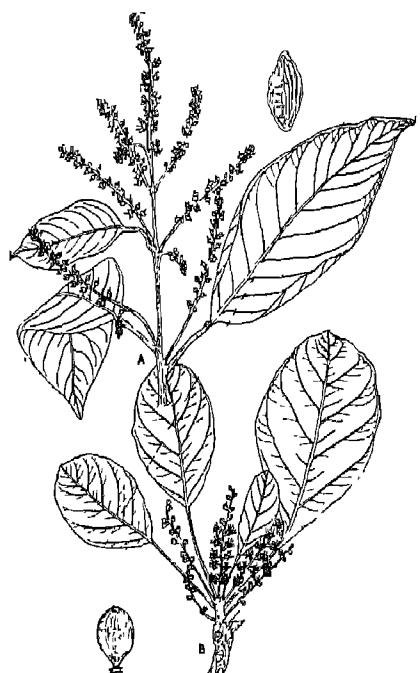


Fig 4.14 Mast tree

relished by bats and flying foxes. In the morning the ground is littered with the seeds, the remains of the previous night's banquet of bats. Festoons of the leaves are often used to make decorative arches with or without various other flowers.

MYROBALANS (also spelt as Myrabolans) and their near relatives of various kinds abound in our country. Many are valuable as timber, tan source and in indigenous medicine. Besides, some of them are often planted by roadsides for shade. The simple leaves can be recognized often by the presence of small glands on their underside between their stalk and blade. The globular buds and the cupular flowers are small, yellowish in colour but being massed together in large numbers on the erect or pendent spikes are rendered conspicuous. They usually have an unpleasant smell but are popular with flies and insects of various kinds. The fruit, a hard almond-like drupe, is angled or winged in some Myrobalans but smooth in others.

CHEBULIC MYROBALAN or HARITAKI of Sanskrit (*Terminalia chebula*, Fig. 4.15A) is a moderate or large deciduous tree with a dark-brown bark exfoliating in woody scales. The fruit is the most useful part of the tree and when dried constitutes the Myrobalans or Gall nuts of commerce. It is ovoid, shiny and faintly angled, about 2.5 centimetres long and is collected when it begins to turn yellow. Since time immemorial this Myrobalan has been used medicinally and for dyeing, for making ink and for tanning. An important drug of the ancient Hindu, *Materia Medica*, is stocked even today in every household as a handy medicine for a variety of ailments. In combination with the Belleric myrobalan and *Aamla* it forms the famous tonic *Triphala*. *Dhanvantari*, the Hindu arch *vaid* is



portrayed holding a *Hari-taki* fruit in the palm of his hand as an emblem of its being a panacea for all human ailments. It was called in Sanskrit as *Pra-nada* meaning life-giver and *Suda* or nectar and the tree bearing it was assigned a mythical origin. In Mysore, mendicants are often nicknamed *Allale Panditaru* literally meaning Myrobalan Pandits.

Fig. 4.15 A. Chebulic Myrobalan
B. Belleric Myrobalan

BELLERIC MYROBALAN (*Terminalia bellerica*, Fig. 4.15B) is a large deciduous tree growing up to 35 metres or more and with a very straight and tall bole, buttressed at the base. It is found in deciduous forests throughout our country and is also often planted along roadsides. The tree is not usually felled because of the superstitious belief that spirits dwell in it. The bark is covered with numerous fine longitudinal cracks. The leaves occur clustered near the ends of the branches. The fruit can be distinguished from that of the Chebulic Myrobalan in that it is not shiny but covered with a grey velvet of minute hair. The Belleric Myrobalan is used for the same purposes as

the Chebulic, but is inferior. The timber known as Barbera in the trade is used for house-building after being steeped in water to increase its durability.

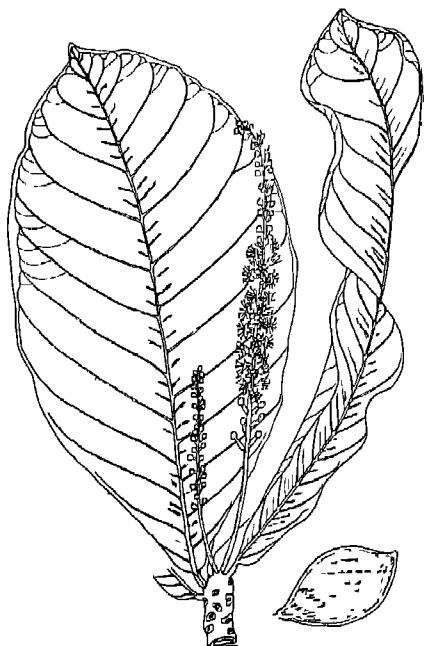


Fig. 4.16 The Bengal Almond described above. It is edible when fully ripe. The bark and the leaves yield a black dye and tannin. The kernel of the fruit yields a valuable oil much like the almond oil in flavour and odour. The tree however is not related to the true almond which belongs to the Peach and Apple family.

ARJUN (*Terminalia arjuna*, Fig. 4.17A) occurs along the banks of streams in Central and South India. In Northern India it is occasionally found in similar places having become established

BENGAL ALMOND or INDIAN ALMOND TREE (*Terminalia catappa*, Fig. 4.16), a native of the sandy coasts of the Andamans and Malaysia, is largely cultivated in East and South India both for ornamentation and for its edible fruit. It is deciduous and the large smooth shiny leaves which occur clustered near the ends of the branches turn red before falling in the hot season. The fruit is compressed and distinctly keeled but not winged, in which respect it is comparable to that of the two Myrobalans described above.

from seeds washed down from the planted trees. The trunk is usually buttressed and the branchlets drooping. The oblong leaves are usually faintly notched at their tips. The Arjun yields a very hard and valuable timber used for building, for making carts, agricultural implements, etc. The tree is also planted along avenues for shade. The fruit has five hard wings in which the nerves curve upwards from the axis. The bark is used for tanning and in the indigenous medicine as a tonic and astringent.

LAUREL (*Terminalia tomentosa*, Fig. 4.17B) is one of the commonest and most widespread of Indian forest trees, ascending to about 1,200 metres in the outer Himalayan hills. It is a large deciduous tree with a long clean bole and a full crown. The bark is deeply fissured and red within. The fruit is five-winged like that of the Arjun but is larger (about five centimetres across) in size. A subtler distinction is that the nerves in the wings do not curve upwards but run horizontally. The hard and strong timber of this tree is used for various constructional purposes—buildings, carts, railways, mine props, bedsteads, etc.

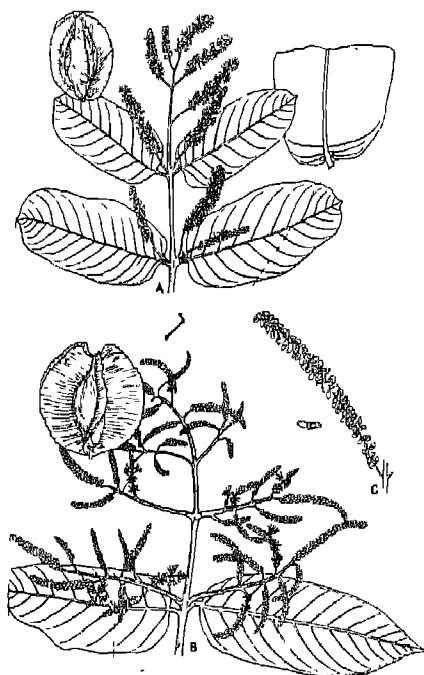


Fig. 4.17 A. Arjun
B. Laurel
C. Hollock

HOLLOCK (*Terminalia myriocarpa*, Fig. 4.17C) is a valuable timber tree of Assam and the Eastern Himalayas. The trees are a handsome sight when in bloom and also when fruiting. The pink two-winged, flat fruit is really minute in comparison with that of the Arjun or the Laurel but is rendered very showy being massed together in spike-like clusters.

AXLEWOOD TREE (*Anogeissus latifolia*, Fig. 4.18A) also belongs to the same family as the Myrobalans. It is a widespread deciduous tree with drooping branchlets. The small flowers occur closely packed in globose heads which ripen into a multiple fruit. Each fruit is a small flattened structure with a beak at its upper end. The timber of this tree is much used for axe handles, axles for carts, poles for carrying load, agricultural implements, etc. It is also a good fuel and gives excellent charcoal. A gum is also obtained which is used in cloth printing.

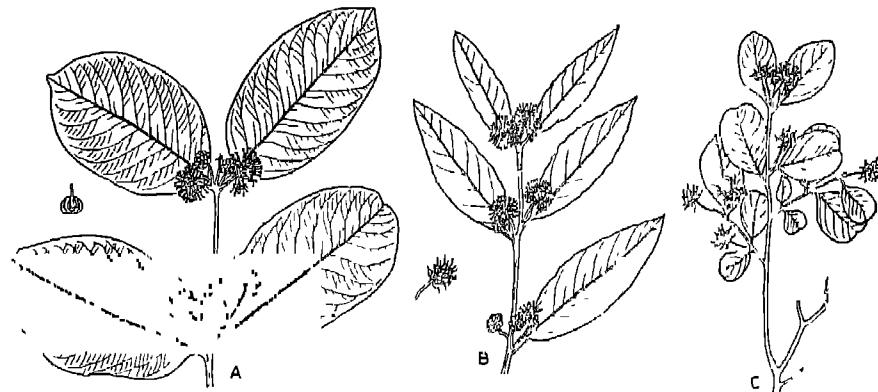


Fig. 4.18 A. Axlewood

B. Yon

C. Kardahi

The leaves are a useful tan material. The related species like the Yon (*Anogeissus acuminata*, Fig. 4.18B) and the Kardahi

(*Anogeissus pendula*, Fig. 4.18C) occur more locally and are put to the same uses as those enumerated for the Axlewood tree.

Bauhinias, of which there are several species native to our soil, are some of our loveliest trees when in bloom. All of them can be readily recognized by their characteristic half cleft leaves with many ribs spreading out from the uncleft base.

PURPLE BAUHINIA (*Bauhinia purpurea*, Fig. 4.19) is similar in appearance to the variegated Bauhinia. Its roots are very poisonous but the leaves are not; they are in fact given as fodder to cattle and goats. The flowers are used in curries and pickles.

VARIEGATED BAUHINIA (*Bauhinia variegata*, Fig. 4.20A) is often grown for its attractive magenta, mauve, pink or white blooms with prominent markings. Buds of this tree are sold and eaten as a vegetable, the leaves used for wrapping *bidis* and the bark for tanning, dyeing and for fibre. Many parts of the tree have medicinal uses. The tree yields a useful gum and from the seeds an oil is extracted.

WHITE BAUHINIA (*Bauhinia racemosa*, Fig. 4.20B) occurs commonly in drier deciduous forests throughout the greater part of India and even up to 1,500 metres, in the Western Himalayas. In Western India its leaves are used for wrapping *bidis*. In Sanskrit it is known as *Vana Rajah*, the King of forests. The small creamy white flowers are borne in racemes. The seeds rattle in the separate pods which however do not break open. The Malabar Bauhinia (*Bauhinia malabarica*, Fig. 4.20C) has more or less the same distribution as the White Bauhinia but its leaves are acid to taste which helps in distinguishing it from other species. Also its pods break open. This species is an important



P. blakeana
1960

Fig. 119 Purple Bauhinia



Fig 420 A Variegated Bauhinia
C. Malabar Bauhinia

B. White Bauhinia
D. Retuse Bauhinia



P. skermann
1960

Fig. 4.21 Portia tree

constituent of *Sal* forests. The Retuse Bauhinia (*Bauhinia retusa*, Fig. 4.20D) also occurs abundantly especially at the altitude of between 900 to 1,300 metres in the Western Himalayas.

YELLOW BAUHINIA (*Bauhinia tomentosa*) is but a shrub or a small tree. It has yellow blooms speckled with red. Known as *Sona* in Marathi, on Dusserah day its small minutely hairy leaves are distributed as tokens for gold. Many other Bauhinias are also small shrubs or extensive climbers bearing watchspring-like tendrils. The Vahl's Bauhinia (*Bauhinia vahlii*), a gigantic woody climber of our forests is a good example of the latter kind. Its extremely large leaves are cleft in the characteristic Bauhinia manner and are commonly used in the North as plates and to wrap food.

PORȚIA or THE INDIAN TULIP TREE (*Thespesia populnea*, Fig. 4.21) has flowers closely recalling those of the Cotton or the vegetable *Bhindi* and belongs to the same plant family. It is common along our coasts where it is often planted as an evergreen shade tree and for ornament. The leaves are simple and heart-shaped; they turn yellow on withering and at first sight one gets the impression that the tree is in full bloom. The bright lemon-yellow flowers arise singly or in pairs and appear all through the year. The calyx is cup-shaped. The five petals are strongly twisted in bud, and drop off as one piece from the rapidly withering flowers. Each petal has a blood-red dot at its base on the inside. The wick-like stigma emerges from a central column of numerous united stamen filaments. The fruit sits loosely in the enlarged calyx cup and turns black on ripening. From the inner bark of this tree is obtained a tough fibre. The bark and heart-wood contain tannin and a fine red

dye. The wood is ideal for boat and house-building, for gunstocks and cart wheels. A yellow dye is obtained from the flower and fruit; juice of the latter applied externally is a cure for scabies and other skin diseases. A tonic is concocted from the roots.

PULA (*Kydia calycina*, Fig. 4.22) is a small tree of our mixed deciduous forests and like the Portia belongs to the Cotton family. It is especially common in the forests of Central India.

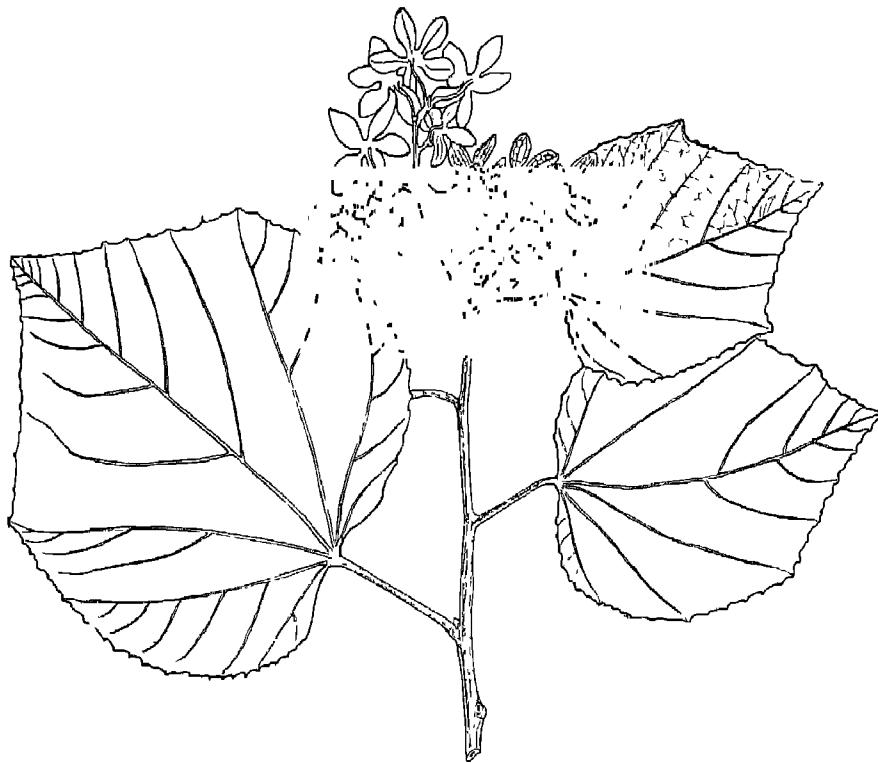


Fig. 4.22 Pula

Its bark peels off in irregular flakes. The leaves are simple, nearly circular in outline and softly hairy. The flowers occur in loose panicles. The fruit is surrounded by the 4-5 spreading wing-like enlarged bracteoles and hang down on the trees for months. The bark yields a strong fibre but the wood is of little value.

The following five trees all belong to the large *Euphorbia* family many of whose members are characterized by the occurrence of a white milky juice or latex in their tissues. In fact it is out of this latex contained in the Brazilian Rubber tree that the commercial rubber is made. The Castor plant also belongs to this family. The flowers are invariably unisexual and the male and female flowers may occur on the same plant or on different ones.

THE INDIAN GOOSEBERRY or the EMBLIC MYROBALAN (*Emblica officinalis*, Fig. 4.23A) is not related to the true Myrobalans as its common name would wrongly seem to indicate but it belongs to the *Euphorbia* family. It is a deciduous tree found both wild and cultivated over the greater part of the country. Its branchlets bearing two regular rows of simple stipulate leaves very deceptively simulate a pinnate compound leaf with numerous leaflets. The small leaves are oblong and recall rather closely the leaflets of a Tamarind leaf. The minute greenish male and female flowers occur on the same branchlet. The familiar *Aamla* fruit is a fleshy, round or slightly six-lobed structure usually with six prominent lines running vertically from the tip to the base. Inside its fleshy portion is a six-ribbed stone which ultimately splits into three portions, each containing usually two seeds. The fruit is green at first,

changing to light yellow or brick-red in colour. There is a great variation in the size and taste of the raw *Aamla* fruit and there is a giant fruited variety known in cultivation. After chewing an *Aamla* fruit, water tastes sweet. The *Aamla* fruit is much used in our country for making pickles, preserves and jellies. Held in very high esteem in the indigenous medicine, it is very rich in Vitamin C. The preparation called *Triphala chooran* contains equal parts of powdered *Aamla*, Chebulic and Belleric Myrobalans, and is used for a variety of ailments. The fruit is also used in the preparation of writing inks and hair dyes. It is also used as shampoo for the head and is said to promote hair growth. The leaves and fruit are used as cattle fodder and as tan material along with the bark.

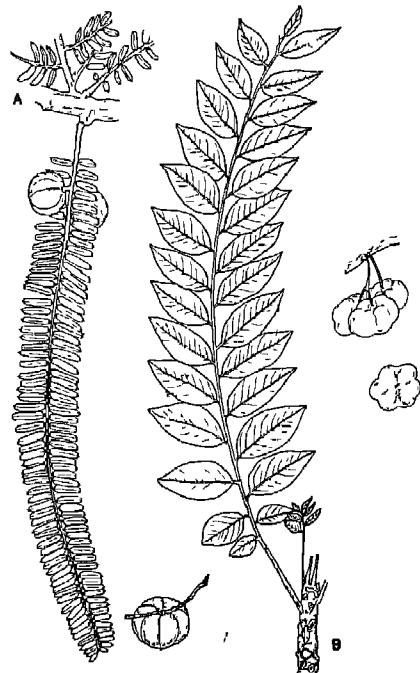


Fig. 4.23 A The Indian Gooseberry
B. Star Gooseberry

STAR GOOSEBERRY, ARANELLI or HARPHARORI (*Cicca disticha*, Fig. 4.23B) is related to *Aamla* but its fruit is deeply lobed and sour. It is eaten raw, cooked, pickled or made into jam or jelly. The tree is usually cultivated in home-yards and gardens chiefly for its fruit which it bears in profuse clusters along the main branches, directly from the old wood.

KUMKUM TREE (*Mallotus philipensis*, Fig. 4.24) occurs widely in our drier forests. A small much branched evergreen tree, its bark is irregularly cracked. The simple leaves are



Fig. 4.24 Kumkum

strongly three-nerved. The underside has numerous minute red glands. The fruit is three-lobed and is covered with a fine felt of red glands on the surface. These are collected and a powder known as *Kamala* extensively used for dyeing silk is prepared.

CHILD LIFE TREE or PUTRANJIVA (*Putranjiva roxburghii*, Fig. 4.25) is a small evergreen tree occurring widely in our forests. It is frequently planted as an ornamental tree or is pruned down for hedges in gardens. The male and female flowers are either borne on different trees or on the same one. The wood is suitable for turnery. The fleshy fruit has a hard seed-containing

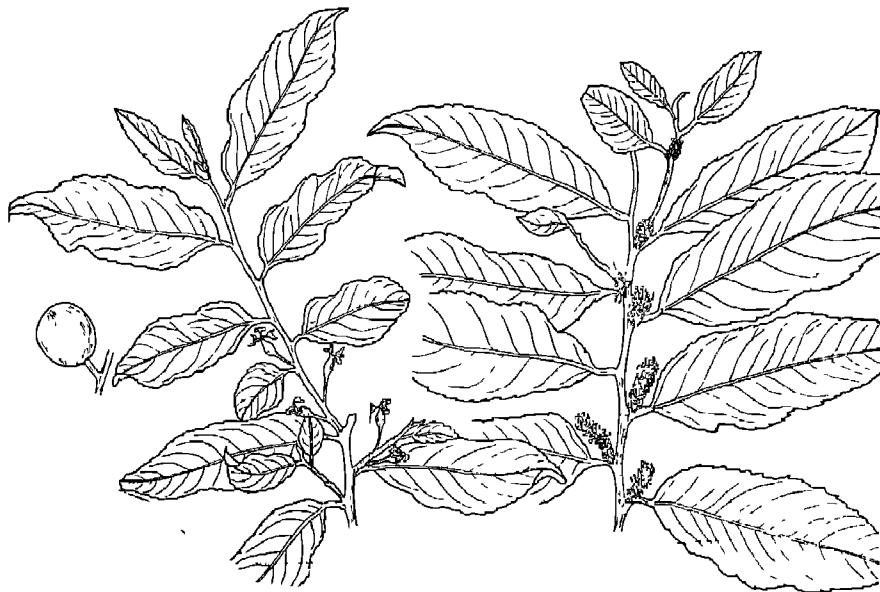


Fig. 4.25 Child Life tree

stone within, which is strung into necklaces for putting on children, the belief being that they ward off evil and ill health. Hence the name *Putranjiva* for the tree.

GUTEL (*Trewia nudiflora*, Fig. 4.26) occurs chiefly in wet slopes and along streams in our forests. Its cordate leaves



Fig. 4.26 Gutel

somewhat resemble those of the Gamari of the Teak family and is hence known by the same name sometimes.

LASORA (*Cordia obliqua*, Fig. 4.27) fruit comes from a native deciduous tree with fragrant white flowers. The leaves are more or less broadly rounded in outline, leathery and rather harsh to touch. The fruit is viscid and none too delicious to eat but it can be pickled and has medicinal properties being used in the treatment of cough and as a laxative. The



Fig 4.27 Lasora

kernels are a good remedy for ringworm. The bark and unripe fruit are a tonic. The wood is ideal for producing fire by friction. It is used for boat-building and for agricultural implements. It is very durable and is said to have been used for making the Egyptian mummy cases.

EHRETIA (*Ehretia laevis*, Fig. 4.28) belongs to the same family as the Lasora. It occurs widely in deciduous and drier forests of the country and is especially common in *Sal* forests.

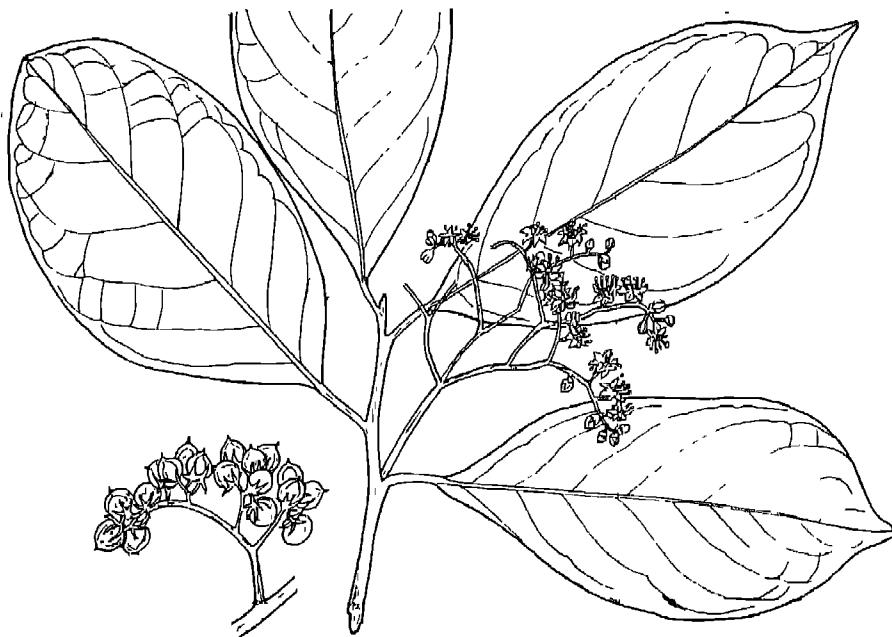


Fig. 4.28 Ehretia

The white flowers appear when the tree is partly leafless. They and the orange-red berries that follow, render the tree conspicuous in the forest.

THE INDIAN JUJUBE or BOR (*Zizyphus mauritiana*, Fig. 4.29) is one of the prickly trees found widely in the country that yield edible fruit. The tree never attains much height, often being stunted. Frequently it is only a straggling bush with

zig-zag branchlets. The simple leaves are small, elliptical, smooth green above and velvety white or brown underneath. Three strong nerves mark each leaf and at the base of its short stalk is either one spine or a pair of one curved and the other straight spine. In cultivated trees the spines are not so prominent and may be absent.

The flowers are tiny, greenish and have a thick disc filling their centre. The petals are hooded over the stamens and more or less conceal them until the flower is fully expanded. The fruit which is very variable in shape, size and palatability, is fleshy with a large bony stone in the centre, containing the seeds. The fruit of the wild *Bor* is used mainly for sherbet but those of the several cultivated varieties are quite large and palatable. They are sold in the market during the season and have been in use since Vedic and pre-Vedic times as evidenced by anthropological finds and by their mention in classical literature. Especially in drier regions and poor ground where it thrives, the Jujube furnishes good timber, excellent fuel, material for fencing in its prickly branches, fodder for camels and goats and fruit for man. Many parts of the plant are medicinal

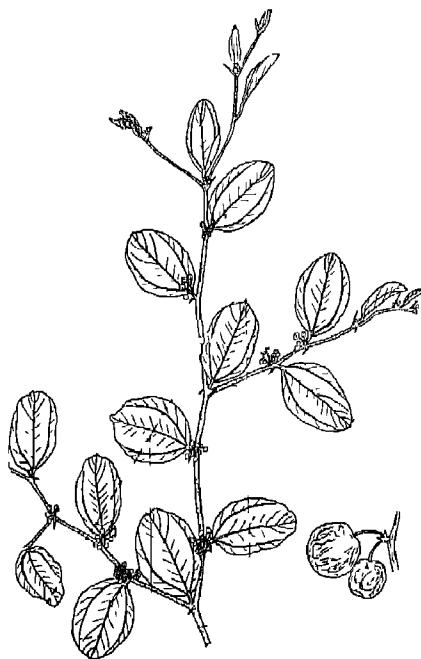


Fig 4.29 The Indian Jujube

and the Tussore and Iri silkworms can be fed on its leaves and the Lac insect also reared on the trees.

ALEXANDRIAN LAUREL or DILO OIL TREE (*Calophyllum inophyllum*, Fig. 4.30) is chiefly a littoral species of the

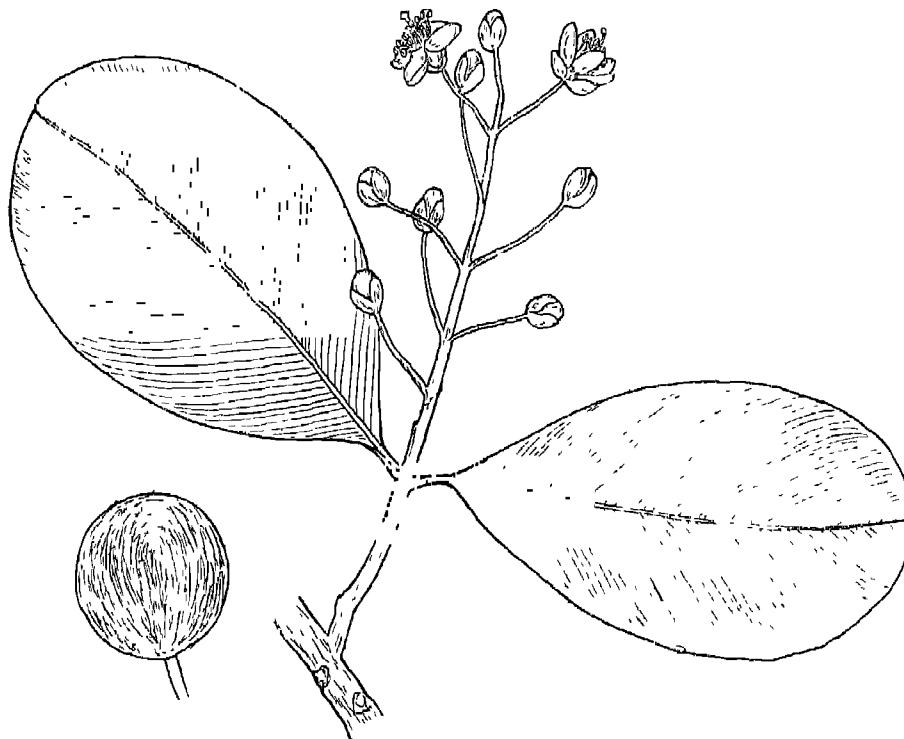


Fig. 4.30 Alexandrian Laurel

South Indian coasts but because of its beautiful fragrant flowers, is widely cultivated elsewhere also. The shiny leathery leaves have numerous close set nerves at right angle to the midrib. Seeds of this tree yield an oil variously called Pinnay, Poonseed,

Dilo or Domba oil which finds several uses. It is an illuminant and useful for making soap, for treatment of skin diseases and in rheumatism. Injected intramuscularly it relieves pain in leprosy. Its bark is also medicinal.

The Poon trees which are other species of *Calophyllum* occur in our evergreen forests and are valued for their timber, which is hard and durable and hence used for a variety of constructional purposes. The Poon Spar tree (*Calophyllum tomentosum*) of the Western Ghat forests attains immense height and girth. Trees of this species with a clean straight bole of 25 metres and a girth of about $4\frac{1}{2}$ metres are common. It is said that centuries ago, the Moors used to come sailing afar to the west coast of South India seeking this large tree for the masts of their dhows. Even today the wood of this tree and other related species is highly valued in boat-building.

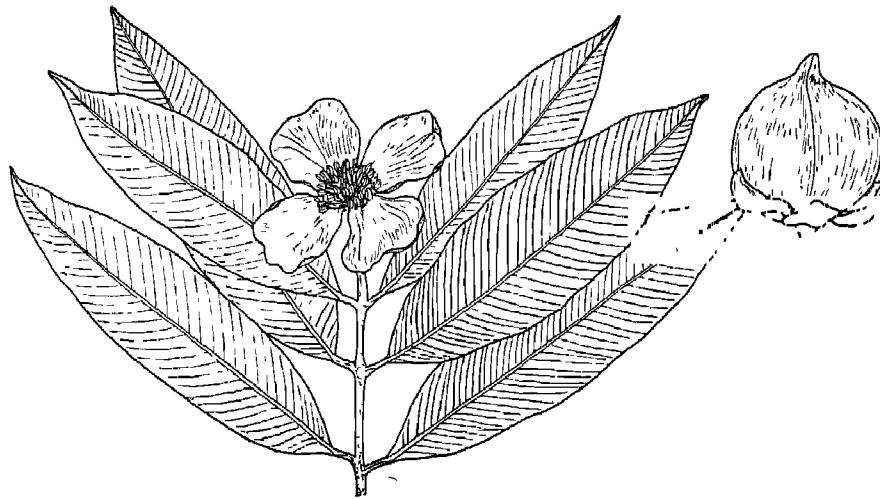


Fig. 431 Mesua

MESUA or IRONWOOD OF ASSAM (*Mesua ferrea*, Fig. 4.31) is a lofty evergreen tree of Eastern and Southern India. It bears large white fragrant flowers. The young leaves change many colours before they fall. The very strong and heavy timber is mostly used for railway sleepers. The Ballagi (*Poeciloneuron indicum*), another valuable timber-tree of the Western Ghats belongs to the same family as the Poon trees and Mesua. The poles of this tree are used for electrical transmission in Mysore. The Mangosteen (*Garcinia mangostana*) introduced in parts of Tamil Nadu yields the delicious fruit of that name.

DILLENIA (*Dillenia indica*, Fig. 4.32) occurs widely in our forests and is also planted as an ornamental tree. It is mostly an evergreen tree with orange-red scaly bark. The simple leathery leaves are long and elliptical with toothed margin and neatly arranged parallel secondary nerves springing from the midrib. The flowers are very large, snowy-white and recall at first sight those of a Magnolia. The fruit is a large round sour fleshy structure encased in the enlarged fleshy sepals which are eaten stewed in Bengal. The fruit is also sometimes used as a

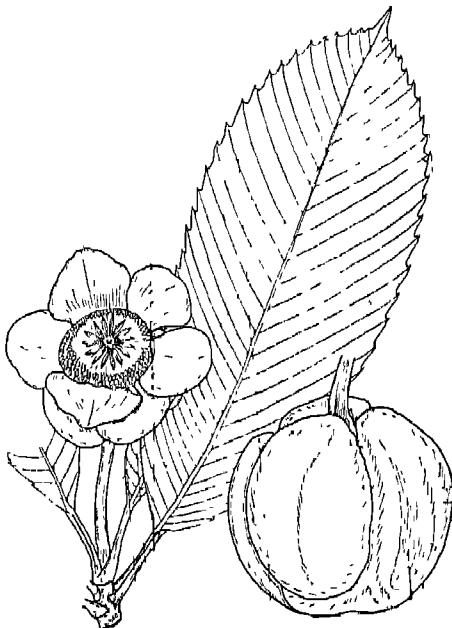


Fig. 4.32 Dillenia

substitute for soap and as a headwash. In nature, they are much sought after by elephants. The tree being common on the banks of streams the fruit often falls into the water and is carried away to germinate where it is washed up a bank. White ants eat away the pulp leaving the seeds unharmed and these germinate in the earth that is deposited in the shell by the white ants.

QUEEN'S FLOWER or CREPE FLOWER TREE (*Lagerstroemia speciosa*, Fig. 4.33) is often planted for ornament. In drier localities and city streets it is short, knotty-boled with crooked branches but in its native wet forests of Assam, Bengal and South India it grows to a tall straight-stemmed timber-tree, In fact known in the trade as *Jarul* its timber has a very high reputation as a strong, hard and durable wood. It is not often that a tree yielding good timber has handsome flowers. The Crepe flower tree is an exception and for that reason is often grown as an ornamental tree. The tree is deciduous but leaf fall is gradual so that the crown appears rarely bare. The leaves turn red before falling. The bark which is light-grey and fairly smooth, peels off in thin irregular flakes. The large flowers appear in long branched clusters. The young buds with ridged calyx look like small figs. The petals are stalked and lie much crumpled in bud and even after unfolding remain crinkled and with undulated margins. They vary in colour from pink to mauve on different trees. A white-flowered variety is also known. New flowers are of a deep tone while older ones fade and almost turn white. Stamens are many. The fruit is seated on the star-like persistent woody calyx. It turns brown and almost black on ripening breaking up into five or six valves and remains



Fig. 4.33 Queen's Flower tree

P. Schumacher
1968

for a long time on the tree even till or after the next flowering and fruiting season.

Many other close relatives of the Crepe flower tree occur in our forests and are some of India's important timber-trees. The Benteak (*Lagerstroemia lanceolata*) and the Lendi or Nandi (*Lagerstroemia parviflora*) are two of these. The Crepe Myrtle (*Lagerstroemia indica*) is very commonly grown in gardens as ornamental bushes but can attain small tree size if allowed to grow. Its flowers are essentially like those of the Crepe flower tree but smaller and of many different colours on different plants. All the foregoing species have capsular fruits and sometimes winged seeds. The Henna or Mehndi (*Lawsonia alba*) bush is another useful shrub of the *Lagerstroemia* family. It is commonly grown for hedges and for the red colour obtained from its crushed leaves which is used for dyeing red the nails, palms and the soles of the feet of women everywhere. In the North even men use it, to dye their hair red.

PAARIJAATA or HARSINGHAR (*Nyctanthes arbor-tristis*, Fig. 4.34) is an indigenous plant which is often planted for its beautiful flowers which are used for worship and as an ornament. When quite old it is a small tree with a crooked trunk. Branches are quadrangular with opposite simple leaves which are very rough to touch. In fact on this account the leaves are used as a sandpaper for polishing wood. The fragrant, star-like flowers arise in loose clusters. They bloom at night and fall on the ground below by morning. A few rude shakings by the hand, of the trunk or branches bring down more of them. The flower has a bright-red tube from which spread out at right angles the white petals. Concealed in the tube are only two

stamens as in the Jasmin of the same family. The fruit is a flat bilobed capsule, green at first and turning almost black with age. The Paarijaata is sacred to the Hindus. According to Hindu mythology this plant sprang along with nectar when the ocean was churned by the Devas and the Asuras. According to



Fig. 4.34 Paarijaata

another belief the plant was brought from Indra's garden in heaven by Krishna at Satyabhama's request. Kalidasa has sung most eloquently of its fragrant flowers in the *Ritusamhara*. Apart from the use of its flowers for worship and for ornament, the Paarrijaata finds several other uses. The red tubes of the corolla yield an orange dye and the wood is an excellent fuel.

SANDALWOOD TREE (*Santalum album*, Fig. 4.35) has made Mysore famous. Not only does it occur plentifully in several parts of the state but also it is an important source of revenue to its government which long ago declared it as a "Royal Tree" which means only the government can exploit the tree wherever it grows within the state borders. The Sandal is a small evergreen tree with slender drooping branchlets bearing small, simple opposite or sometimes whorled leaves with a shiny upper surface. The small flowers occur in loosely branched clusters. At first they are pale-yellow, then brownish-purple. The four or five stamens in a flower alternate with an equal number of rounded coloured scales each opposite a petal. The fruit is a drupe, black-purple when ripe. The Sandal is one of the few trees which are parasitic on other plants. Some of its roots attach themselves to those of the surrounding plants and seem to partially draw nourishment from them. Whether you crush the leaves of Sandal or smell its flowers you will not find any scent whatever because the highly valued scented oil is contained only in the heart-wood of old trees which constitutes the well-known sandalwood of commerce from which the Sandal oil is also distilled. The Sandalwood as such is carved out into various fancy fragrant articles like boxes, statues, frames, etc. The sandal paste formed by rubbing the wood and known as Chandana or

Chandan has been in use in our country since time immemorial for worship and as a soothing balm to allay prickly heat,

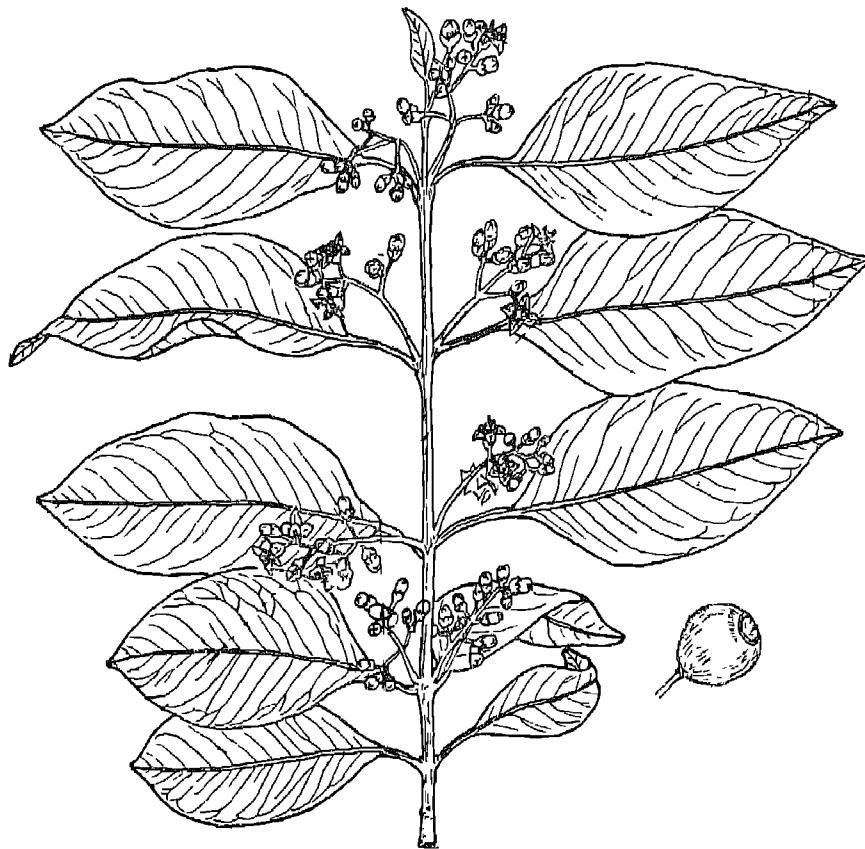


Fig 4.35 Sandalwood tree

burns, etc. The highly fragrant Sandal oil is used in perfumery, soap-making and in medicine. The Mysore Government exports

large quantities of it every year. The Sandalwood tree often suffers from a destructive disease called the Spike disease, which causes damage worth several lakhs of rupees every year.

The Sterculia family is well represented in our flora and several trees of this family occur in our forests. Some of them have simple leaves whereas in others the leaves are palmately compound as in the Wild Almond tree described later in this chapter.

SCARLET STERCULIA (*Firmiana colorata*, Fig. 4.36) is a moderate-sized deciduous tree of forests of Central and South India. It has 3-5 lobed leaves which recall those of the Cotton plant. The scarlet-red flowers appear in loose clusters when the tree is leafless and present a gorgeous sight. The colour is due to scarlet-red hair which densely cover the flowers like a velvety coat. The fruit is unusual in that it opens long before maturity into membranous leaf-like parts with the seeds attached along their margin. These follicles are attractively coloured when young and on drying detach easily and are blown about by the hot dry winds of the season.

KATIRA GUM TREE (*Sterculia urens*, Fig. 4.37) is found widely in our drier forests and has flowers structurally very



Fig. 4.36 Scarlet Sterculia



Fig. 437 Katira Gum tree

similar to those of other *Sterculias*. The tree is completely leafless during part of the year. The bark is whitish and peels off in thin flakes. The fruit is woody and breaks up into five spreading valves which are densely soft hairy and armed with stiff stinging bristles. The white gum exuding from the bark and known as Katira gum is used in confectionary and in ice-cream and therefore finds a good export market. The inner bark yields a strong fibre.

PTEROSPERMUM (*Pterospermum acerifolium*, Fig. 4.38) is a handsome evergreen tree with large simple irregularly shaped leaves, green above and greyish-white or rusty-coloured beneath. The large, sweet scented flowers are borne singly or in pairs in the leaf angles. They bloom at night and fall by morning. Bats visit them. The sepals are long, thick and curl backwards as the flower opens. The woody five-angled fruit is densely covered with woolly hair on the surface. It bursts open into five thick valves inside which the winged seeds are neatly arranged. The down on the leaves is used by the hillfolk to stop bleeding. The wood is used for planking and furniture. The leaves are used for packing and as plates.



Fig 4.38 Pterospermum

PTERYGOTA (*Pterygota alata*, Fig. 4.39) occurs in North-East India, Andamans and the Western Ghats in South India. A large evergreen tree in its native habitat, it is much cultivated for ornament and as an avenue tree. The fruit is a large woody structure containing very broadly winged seeds which can be eaten.

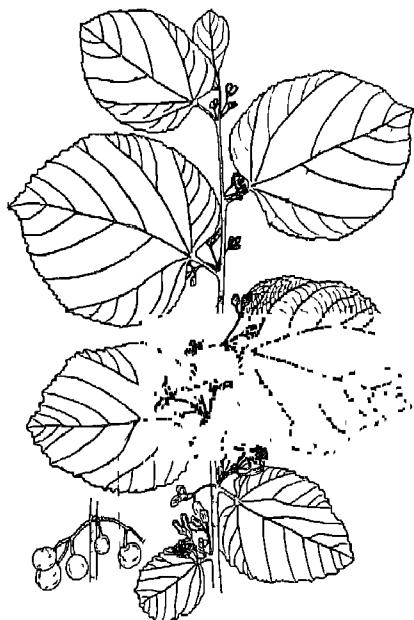


Fig 440 Phalsa

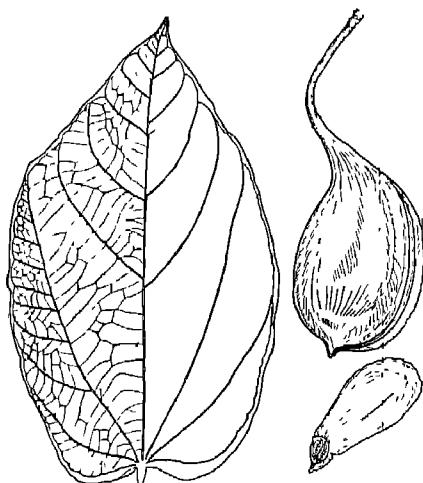


Fig 439 Pterygota

GREWIA (*Grewia* species) are small- or middle-sized trees of our drier forests. The dark purple fruit of *Phalsa* (*Grewia subinequalis*, Fig. 4.40) which ripens during the summer months is sold in the market. It is eaten as such or made into sherbet. Either way it is said to be very good for allaying the adverse effects of summer heat. The timber of this species as well as of some closely related ones and known in the trade as *Dhaman*, is put to a variety of uses.

RUDRAKASH TREE (*Elaeocarpus ganitrus*, Fig. 4.41) is well known because the hard, warted ornamental stones of its fruit are strung upon a cord and made into necklaces or rosaries which are often seen worn by our Sadhus and religious men. Stones of other Elaeocarps are similarly used. The fleshy outer part of the fruit is edible.

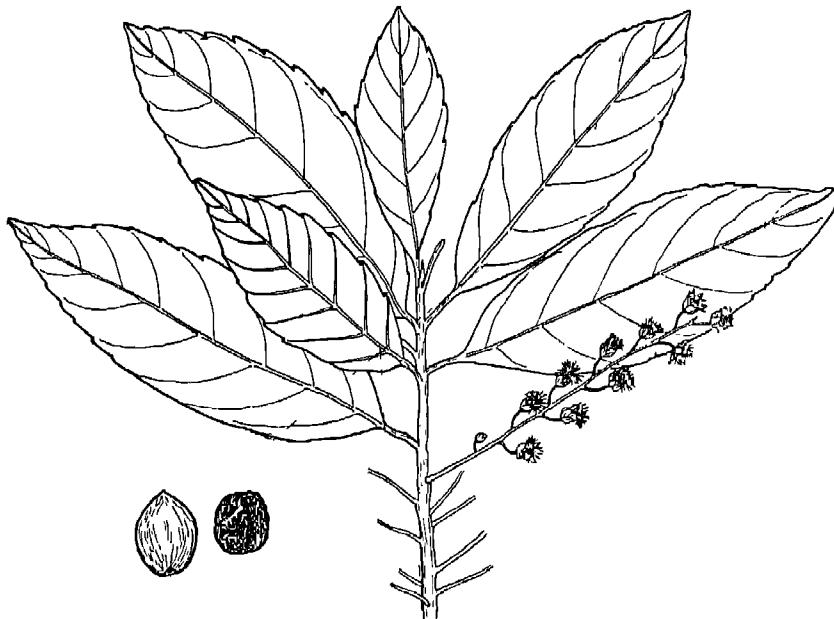


Fig. 4.41 Rudrakash tree

BANDOR KEKUA (*Sloanea assamica*, Fig. 4.42) is a relative of the Elaeocarps and is an inhabitant of the evergreen forests of Assam and NEFA. It is said its round fruit which is densely covered with long spines, was used in the days of the Ahom kings of Assam for punishing criminals. First, wounds were

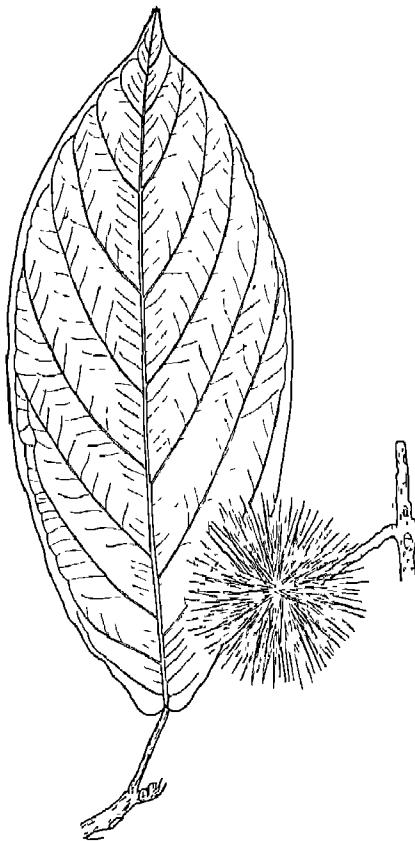


Fig. 4.42 Bandor Kekua

valuable gum, the Kateera gum (which is also obtained from another of our native trees namely *Sterculia urens* described earlier), a useful minor forest product that finds use in Calico printing, paper-making, etc. Indian cobblers use it for leather dressing. It is also a sedative and cough remedy. Several

inflicted by beating them with this sharp fruit and then upon these were sprinkled salt and water.

YELLOW SILK COTTON TREE (*Cochlospermum religiosum*, Fig. 4.43) is a small crooked tree found in dry hilly districts, thriving in the hottest and stoniest places. It is often planted near temples for its large golden-yellow flowers that arise in large numbers when the tree is leafless in March every year. The new leaves soon follow the flowers and form a leafy crown. Unlike the Red Silk Cotton tree the leaves here are simple though divided. They rather closely recall those of the Cotton plant. The seeds are covered in a silky floss that floats and carries them over long distances. This tree yields a



Fig. 4.43 Yellow Silk Cotton tree

million pounds of this gum are annually exported from India for use abroad in the Cigar and Ice-cream industries.

CASUARINA or BEEFWOOD TREE (*Casuarina equisetifolia*, Fig. 4.44) is so deceptively like a conifer that it is often mistaken for that one. But it is a flowering plant and what looks like narrow needle-like leaves are in fact green branchlets that function like leaves. The real leaves are reduced to small

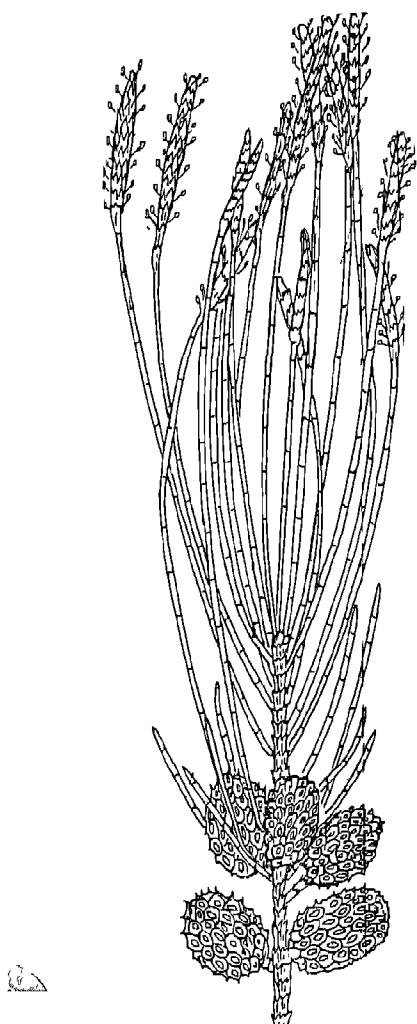


Fig. 444 Casuarina

triangular scales that occur in whorls at every joint of these green branchlets. The hard, round woody collective fruit may be mistaken for the cones of the true conifers thus making confusion worst confounded. On account of its preference for sandy soils and its value as an excellent fuel, the Casuarina is extensively planted for reclaiming sandy sea shores in South India where it is also grown far inland and often planted as a roadside or garden tree. It can also be made into a good dense hedge. The wind whispers and sighs through the branches of a Casuarina. The strongly branched trunk is clothed with a rough bark which cracks and comes away in long strips. The green leaf-like branchlets fall throughout the year, forming a spongy carpet beneath plantations such as that one finds in natural pine woods. The flowers are unisexual, the male appearing in cylindrical terminal spikes, the female in dense heads which lie in the axils of the branchlets and

later ripen into the cone-like collective fruit. The wood of the Casuarina is one of the best fuel woods in the world and has a high calorific value. It burns even when not quite dry and makes excellent charcoal too.

TEAK (*Tectona gradis*, Fig. 4.45) is one of the world's most valuable timber-trees. It occurs wild or is planted in many of

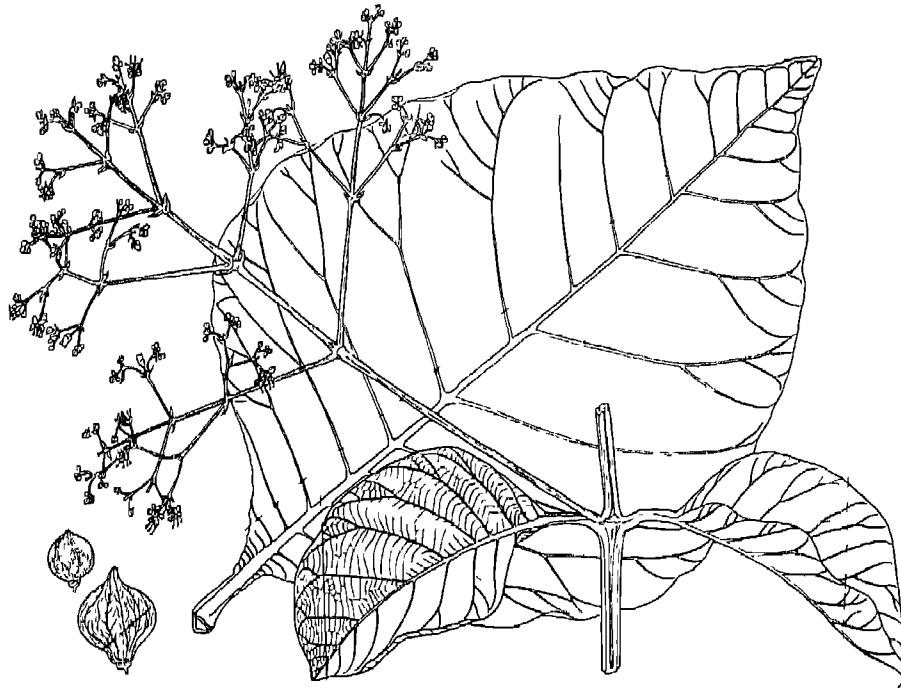


Fig. 4.45 Teak

our forest areas which are either forest-free or where frost is light and does not occur every year. Nobody traversing Central India by train can miss the great belt of teak forests

of that region. There are good teak plantations in Kerala, Orissa and elsewhere too. Under favourable conditions the Teak can attain a height of 45 metres but to do so it may take 60-80 years or more. The bark is relatively smooth and peels off in vertical strips. The branchlets are quadrangular. The leaves arise in opposite pairs each pair being crosswise to the next pair below or above it. They are simple and large; in young trees even larger sometimes being as much as 60 centimetres long. Underneath, they are like soft felt, backed by hard brown cords but above they feel like fine sandpaper to touch. The microscopic examination of the leaf surfaces reveals many kinds of hairy outgrowths and sometimes also blands. For the greater part of the year the Teak is ugly to look at because a certain type of insect eats away all the softer tissues of the leaf leaving behind only the skeleton of veins. When the leaves are about to fall the sight is uglier. Ultimately in the dry season every leaf falls forming a carpet on the forest floor. Only when the tree bears the healthy new foliage and flowers it presents a tolerably good look. The small whitish mildly scented flowers arise in innumerable numbers from many subdivided branchlets that together form a pyramidal skeleton overtopping the foliage. Only a small number of the innumerable flowers on each inflorescence ripen into fruit. The rest drop off leaving behind only the framework of much divided branchlets that bore them before. The fruit that develops looks like a green Japanese paper lantern because its calyx also grows and keeps pace with it, eventually forming the loose papery bladder about 2.5 centimetres across and concealing the much smaller furry, bony-hard nut-like fruit within.

The wood of teak is one of the finest timbers in the world. It is not very heavy but yet it is hard, durable and seasons well. Hence the high esteem in which it is held. It is easily worked and is well-known for its natural resistance to white ant attack. The oil it contains preserves the nails driven into it and does not corrode even in contact with it. No wonder it is one of the best timbers for furniture, doors, panelling in ships and railway carriages. It is also preferred for laboratory tables and benches where it stands well the vagaries of water, acids, burns, etc.

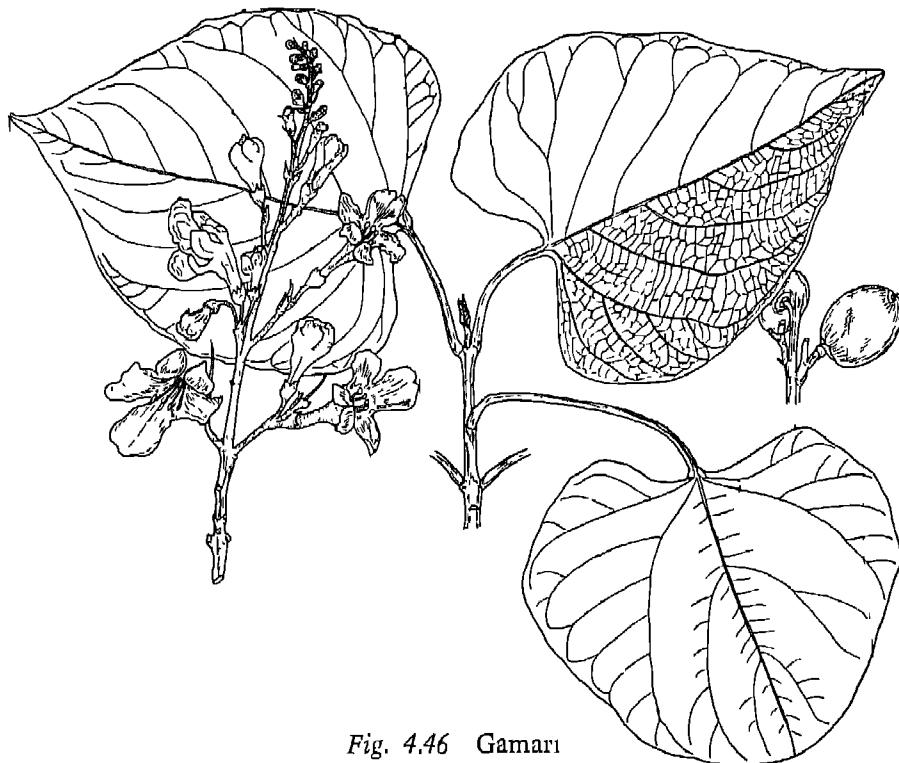


Fig. 4.46 Gamari

GAMARI (*Gmelina arborea*, Fig. 4.46) belongs to the same family as Teak but has irregular and more tubular flowers. The leaves are cordate and more or less hairy beneath. The tree is found widely but occurs usually scattered in mixed forests. Since it is a fast-growing one whose wood can be put to a variety of uses, forest departments usually raise plantations of this native tree which has done quite well in many other tropical countries of the world.

The Dipterocarp family is a fraternity of forest trees of the Indo-Malayan region. Many of them yield a valuable timber. A few also give useful oils like Gurjan and resin-like White Dammar. The *Sal*, Dipterocarps, Piney Varnish tree all belong to this very useful family of forest trees.

SAL (*Shorea robusta*, Fig. 4.47) forms fine forests in the Sub-Himalayan tracts from Uttar Pradesh eastwards to Assam. It is a partly deciduous, gregarious tree covering extensive forest areas. It also occurs in Central India but not in the South where some other related species however occur. The bark is thick, rough and furrowed. The leaves are simple, deep green with wavy margins. The clusters of fragrant flowers appear in springtime. As in other Dipterocarps, the sepals of the flowers persist and grow with the fruit to form wing-like expanses helping its dispersal by wind. There is no dormant or rest period for the seeds and they germinate soon after they are mature. The *Sal* timber is hard and of great durability. Many lakhs of cubic centimeters of this wood is supplied as sleepers to our railways every year by the forest department. The wood is resistant to white ants and is for this reason highly valued for constructional work indoor as well as out of doors. A few

other related species of South India and Assam are put to the same uses as the *Sal*.

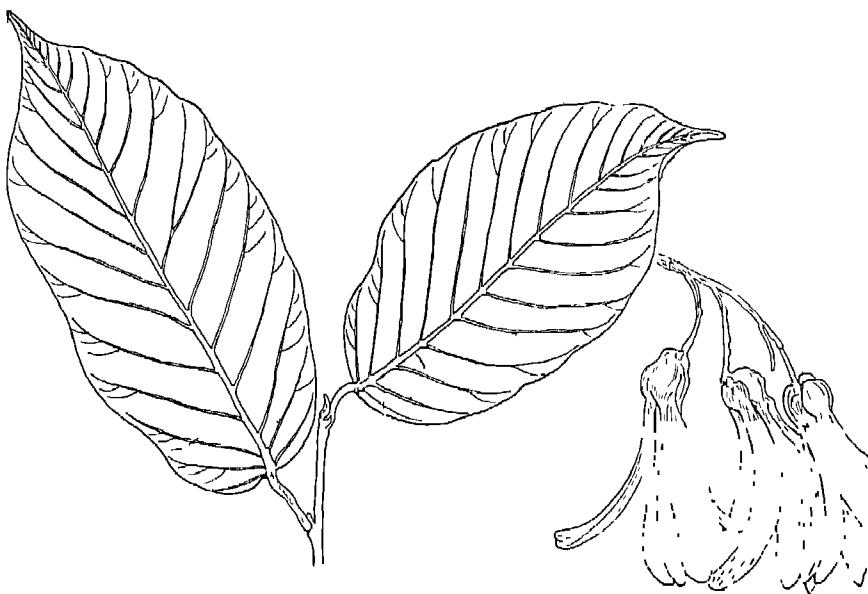


Fig. 447 Sal

DIPTEROCARPS (*Dipterocarpus* species, Fig. 4.48) are gigantic trees towering over the canopy of our wet evergreen forests. They belong to the same tree family as the *Sal* and can attain heights of 45 to 60 metres. They have well-formed light coloured boles supported by buttresses and a compact crown of branches and foliage at the top. The bark is thin and scaly in the very wet regions but deeply furrowed in the drier zones. The leaves are elliptic, dark-green, glossy and with regular secondary nerves. The stipules are long and sheath the apical leaf bud. When they fall, they leave behind a conspicuous

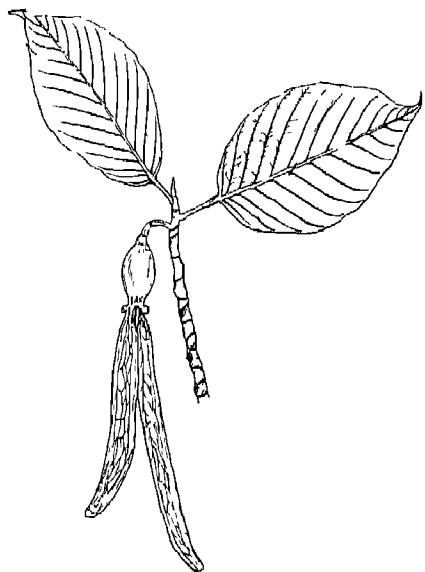


Fig 448 Dipterocarps

scar on the stem. When unopened stipules are pressed with the fingers they explode with a noise. The fruit is like a shuttle-cock, the sepals enlarging in the fruit to form papery wings helpful in dispersal. The Hollong (*Dipterocarpus macrocarpus*) is one of the common timbers of Assam.

The Piney Varnish or Indian Copal Tree (*Vateria indica*) is a denizen of the evergreen forests of the Western Ghats where it occurs associated with the other Dipterocarps, Jack, Poon, Mesua, Malabar Mahogany, etc. This tree yields a

gum resin of excellent quality. It is extensively planted as an avenue tree in South Kanara and Kerala.

KARANI (*Cullenia excelsa*) belongs to the same family of trees as the Red and White Silk Coton trees and the Baabab but unlike them it has simple undivided leaves. This tree is common in the Western Ghats.

EBONIES (*Diospyros species*) are tropical hardwood timber trees. The True Ebony tree (*Diospyros ebenum*) occurs in our evergreens forests. Its heart-wood is almost black in colour and is used for making ornamental articles. The Andaman Marble Wood or Zebra Wood (*Diospyros marmorata*) is also an ebony

whose hardwood is often streaked with black and is extremely ornamental. The *Bidi* Leaf Ebony or Tendu (*Diospyros melanoxylon*, Fig. 4.49) is found widely in the plains and hills, but



Fig. 4.49 Bidi Leaf Ebony

is especially common in Central India. It is a medium-sized or large tree with the greyish-black bark peeling off in regular rectangular scales. The leaves of this tree are much in demand for wrapping *bidis* and a very large number of them are collected each year under contract in government forests and sold. The Madhya Pradesh government has in recent years earned an annual revenue of a crore of rupees from the sale of the Tendu

leaves alone. The timber of this species is also valuable and is used as a substitute for the True Ebony. The Kakī Persimmon tree (*Diospyros kaki*) is another useful species of the Ebony group which is cultivated in some places for its edible red fruit having a gummy aromatic taste.

KADAM or KADAMBA of Sanskrit (*Anthocephalus chinensis* Fig. 4.50) is a common deciduous tree of our forests. It is planted widely along avenues. The simple leaves are borne in opposite pairs with the stipules between them as is characteristic of this family of plants to which also belong the Coffee bush and the Cinchona tree. The small orange-coloured fragrant flowers of the *Kadam* are borne in large and very attractive ball-like clusters and find praise in early Sanskrit literature. The *Kadam* wood is put to various uses.

The *Kadam* has some useful close relatives in our forests. They are the *Haldū* (*Adina cordifolia*, Fig. 4.51A), the *Kaim* or *Phaldū* (*Mitragyna parviflora*, Fig. 4.51B) and the Al Dye tree (*Morinda citrifolia*, *M. tinctoria*, Fig. 4.51C). The *Haldū* occurs throughout the sub-Himalayan tracts and also in deciduous forests of South India. Its trunk is often irregularly fluted and buttressed. The flowers occur in ball-like clusters like those of the *Kadam*. The wood is yellow from whence its Hindi name. It is put to a variety of uses including that of making bobbins for our vast textile industry. Perhaps the local abundance of this tree gives the name Haldwani to a place in Kumaun, near Nainital. The *Kaim* or *Phaldū* is a deciduous tree that occurs widely in our forests. Its timber is valuable and generally used for the same purposes as that of the *Kadam* and the *Haldū*. So also is that of the *Kuthan* (*Hymenodictyon excelsum*, Fig. 4.52).

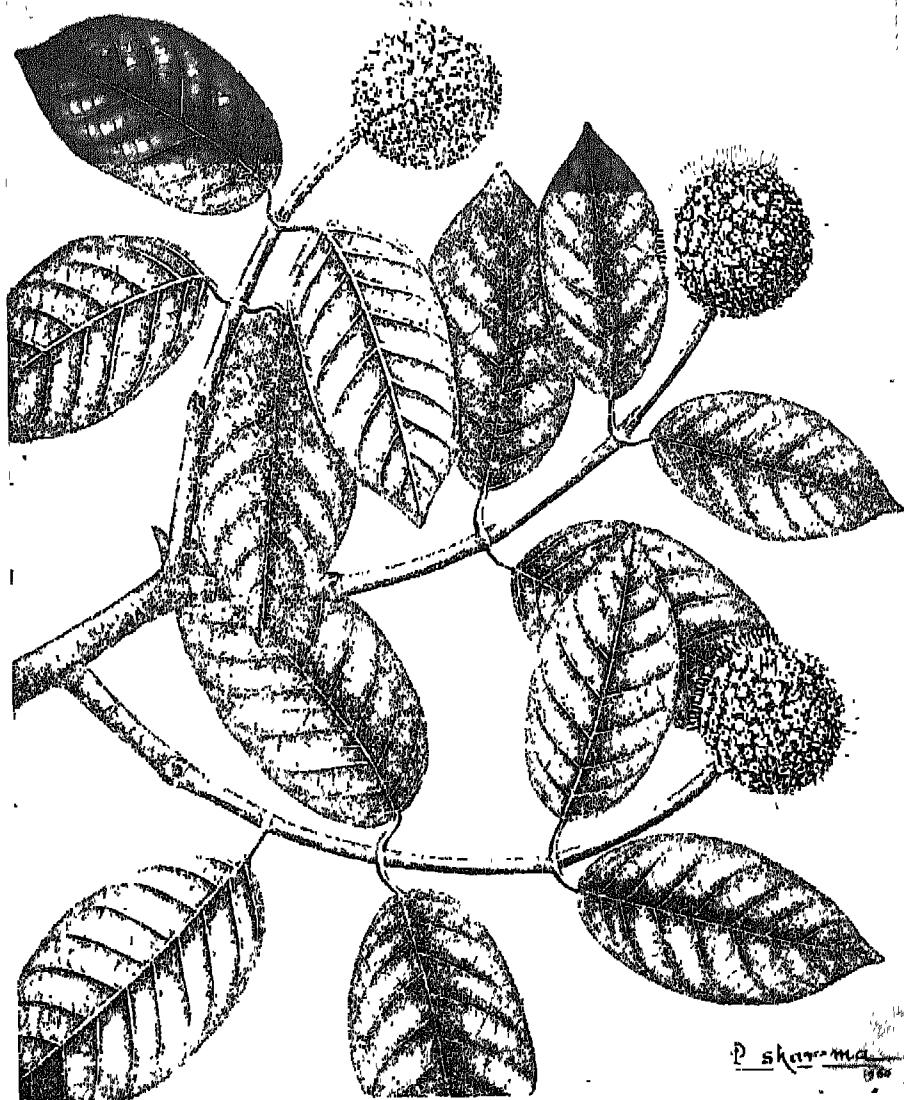


Fig. 10 - Isadum

D. Skurman



Fig 451 A Haldu B Baum C Al Dye tree

whose flowers however are not borne in heads but in elongated spike-like clusters. The Al Dye tree also bears its flowers in globose though less dense heads. Once this tree used to be cultivated on a large scale in various parts of our country for



Fig. 452 Kuthan

its root bark from which was extracted the Al Dye for dyeing red and yellow, cotton, wool and silk. With the advent of synthetic dyes the tree has lost much of this value. It is nevertheless often planted as a shade tree and as support for vines. It is also lopped for fodder; the fruit and pulp are eaten, the latter also fed to silkworms. Pulp is used for cleansing hair.

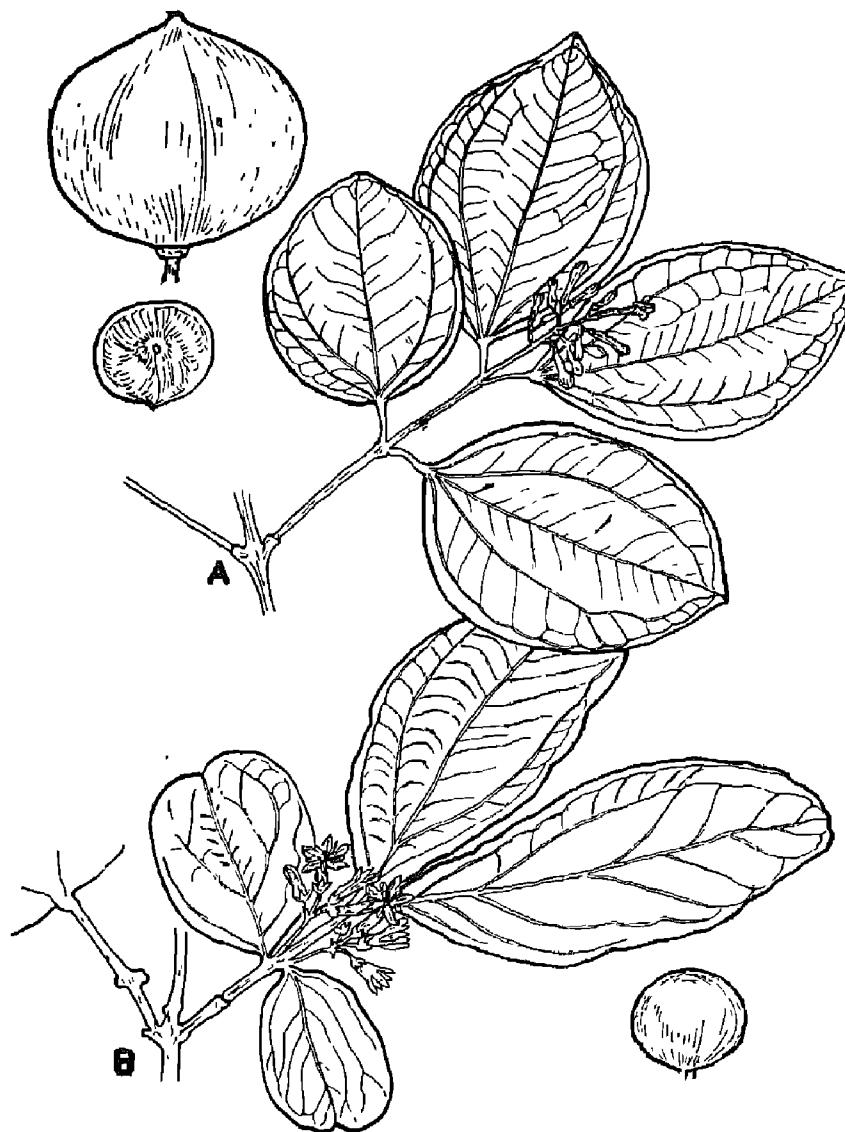


Fig 5.53 A. *Nux vomica*
B. Clearing Nut tree

NUX VOMICA or THE SNAKEWOOD TREE (*Strychnos nuxvomica*, Fig. 4.53A) occurs in the deciduous forests of South India. It has simple five-nerved leaves in which the three central nerves are prominent. The orange-red berries contain 3-4 shiny coin-like seeds. The latter are a strong poison in larger doses but a stimulant in very small ones and hence is used as such in medicine. They contain an alkaloid called Strychnine. The seeds are largely exported from Tamil Nadu and Maharashtra to Europe and America. The Clearing Nut tree or Nirmali, (*Strychnos potatorum*, Fig. 4.53B), another related tree of our forests, has black berries with round compressed seeds. The latter are not poisonous like those of the Nux vomica. In fact our villagers use them for rubbing on the inside of vessels containing muddy water which thereupon miraculously clears up by precipitation of its impurities. Hence the name Clearing Nut tree. *Curare* or *Wourali* is a powerful arrow poison used by aboriginal South American Indians which was obtained from the bark of yet another related South American species.

CINNAMON TREE (*Cinnamomum zeylanicum*, Fig. 4.54) does occur in evergreen forests of the Western Ghats but the high grade Cinnamon of commerce is imported from Sri Lanka. The bark is peeled in strips in the rainy season, the unwanted inner layers scraped off after some fermentation and the strips then dried into the form of quills which are then rolled, bundled and graded for export. Either as small pieces or as powder Cinnamon is an essential ingredient of our *masalas*. The bark of other native Cinnamon trees is cheaper but a poorer substitute. Cassia Cinnamon or *Tejpata* (*Cinnamomum tamala*) is used as a spice is one of them. Natural camphor tree is another product from the



Fig 454 Cinnamon tree

Sino-Japanese species *Cinnamomum camphora* sometimes cultivated in our gardens. However, much of the camphor used today in our country is synthesised from the Pine resins.

NUTMEG TREE (*Myristica fragrans*, Fig. 4.55) is occasionally cultivated in heavy rainfall areas of South India where there also occur other wild Nutmeg species like *Myristica malabarica* *Knema attenuata*, etc. The orange-red, lacerate arils covering the seeds of the Nutmeg trees constitutes the Mace of commerce, a spice in use since ancient times in our country, while the seeds themselves are the medicinal nutmegs.

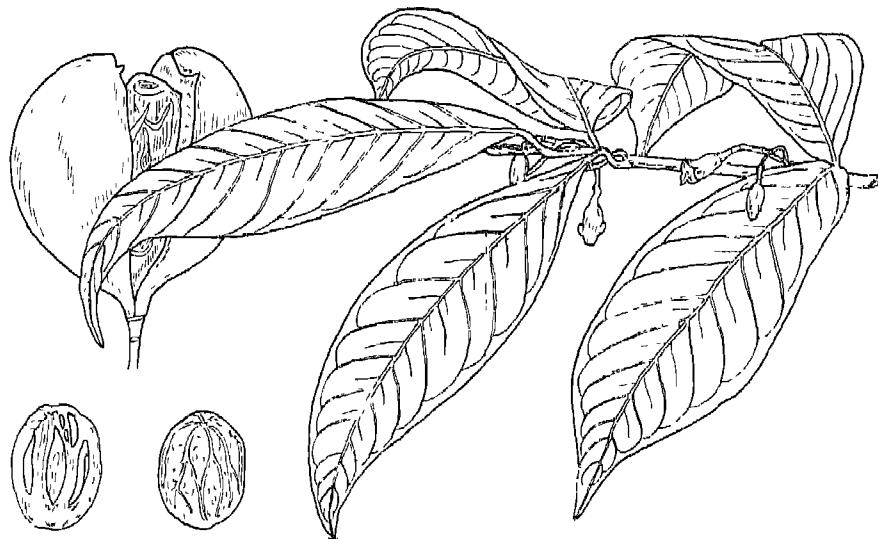


Fig 4.55 Nutmeg tree

The Oleander family or Apocynaceae has some native and introduced trees in our country, besides a number of ornamental shrubs, herbs and climbers commonly grown in gardens. The

native *Sarpagandha* (*Rauwolfia serpentina*) is a famous drug plant well known to our ancients. It has gained prominence again in recent years, since its tuberous roots yield Serpasil, a specific antidote for high blood pressure. Members of this family are characterised by the presence of a white latex. The corolla is tubular with the petals strongly overlapping and twisted in bud. Seeds of some members are crowned with a parachute of silky hair which aids in wind dispersal. The following five trees represent this family.



Fig. 456 A. Wrightia B. Scholar's tree C. Karaunda D. Cerbera

WRIGHTIA (*Wrightia* species, Fig. 4.56A) is a small deciduous tree of our forests whose leaves and stems when bruised exude the latex characteristic of the family. The flowers occur in groups. The seeds are crowned with a tuft of silky hair at the pointed end. The soft white wood of the tree is used for making combs, toys (the famous Channapattana toys of Mysore for instance), etc.

SCHOLAR'S TREE or DEVIL'S TREE (*Alstonia scholaris*, Fig. 4.56B) is a tall evergreen tree of our forests and is planted for avenues and in gardens. Its slender pendulous fruit which hangs down in clusters from the branches can be as long as 30-60 centimetres. The soft white wood is like that of Wrightia and similarly used. One of the uses is for making black-boards in Burma from whence the species name *scholaris*. The reason for the alternative common name, Devil's tree, is because in Western India the tree is considered to be an abode of evil spirits.

KARAUNDA (*Carissa carandus*, (Fig. 4.56C) is a small thorny tree or a mere bush of our drier forests. It is often cultivated for its fruit which is used as vegetable or made into pickles, chutney and jams. The thorns are often forked at their tip.

CERBERA (*Cerbera manghas*, Fig. 4.56D) occurs in the backwaters and tidal forests of the East and West coasts. Its large fibrous fruit is light enough to keep afloat and is disseminated by water.

CONESSIA HALORRHENA or EASTER TREE (*Halorrhena antidyserterica*, Fig. 4.57) is easily confused with the Wrightia which it resembles in flowers and seeds. It yields the Kurchi bark which is a good cure for dysentery.

The Temple tree, Pagoda tree or Indian Frangipanni also belongs to the Oleander family but is dealt with in Chapter 7.



Fig. 457 Conessia Halorrhena

GYROCARPUS (*Gyrocarpus americanus*) is a large common deciduous tree of the drier forests of the Eastern Ghats and generally of Southern India. The small unisexual flowers are borne in dense hairy cymes on the older branches. The fruit is crowned with two large lance-like wings. The wood of the tree is largely used for catamarans, boxes, trays and toys.

LAMPAATI (*Duabanga grandiflora*, Fig. 4.58) is a lofty deciduous tree of Eastern Himalayas and Assam. It has drooping branches bearing the large opposite leaves in close ranks. The



Fig. 4.58 Lampaati

flowers are large with thick sepals. The crimped white petals fall away early. The timber of this tree is used locally for a variety of purposes.

AGARWOOD or EAGLEWOOD TREE (*Agularia agallocha*) is a tall evergreen tree common in Assam. Some of the trees become diseased and portions of their wood become infiltrated

with a resinous substance. Particularly such infiltrated wood has been highly valued as incense since early times under the name of *Aguru* or *Agaru* in Sanskrit.

PIPLI (*Exbucklandia populnea*, Fig. 4.59) is one of the most valuable trees of the Darjeeling hills in the Eastern Himalayas. It is an evergreen tree with simple shining heart-shaped leaves and thick fleshy stipules. It is one of the best trees for afforestation and for the protection of hill slopes that are liable to



Fig. 4.59 Pipli

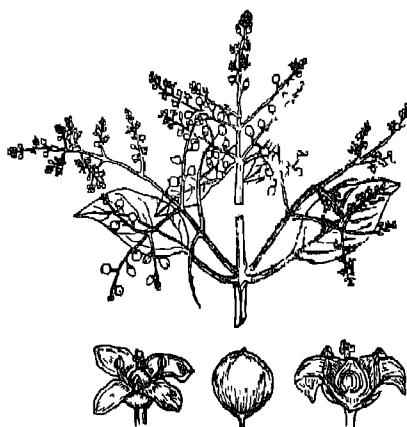


Fig. 4.60 Toothbrush tree

landslides. The reddish-brown wood is durable and locally used variously for planking, flooring, doors and window frames.

TOOTHBRUSH TREE (*Salvadora oleoides*, Fig. 4.60) is a very common tree in the dry and arid regions of India. It is usually seen in Rajasthan, Punjab, Delhi and Agra. It can grow well in saline and black cotton soils and is also seen in

the coastal districts just above the high watermark. The tree is a small evergreen with drooping branches and a crooked or slanting trunk. The leaves are thick, fleshy and brittle, the two surfaces being more or less alike in appearance. The twigs of the tree are often used as toothpicks. Green parrots greedily feed on the small red-coloured berries. It is a valuable shade tree in dry districts.

CAPER TREE (*Capparis decidua*, Fig. 4.61) is a spinous shrub or small tree with a crooked trunk. This plant occurs in the driest



Fig. 4.61 Caper tree

regions of South and North India and is common in the Rajputana desert. The small fleshy leaves fall away from the shoots early leaving behind the stiff cylindrical green branchlets to perform their function. These are armed with curved stipular thorns. The orange-red flowers borne in the dry season are pretty as also the fleshy pink fruit. Both the flower buds and the fruit are commonly pickled. The wood finds several uses in the desert areas where other trees are generally hard to come by. The root and bark are medicinal.

TAMARISKS (*Tamarix* species, Fig. 4.62) mainly occur in the dry and arid north-western regions of our country. In nature, they prefer to grow on sandy river banks and dry river beds and some of them can stand well moderately saline soils. In general habit they recall some Cypresses since the leaves are small, narrow, scale-like with a broad base and closely flattened on the twigs. In the plains of Punjab, the wood of some Tamarisks is used for making ploughs, persian wheels, ornaments, and for fuel.

BLINDING TREE (*Exoecaria agallocha*, Fig. 4.63) is very

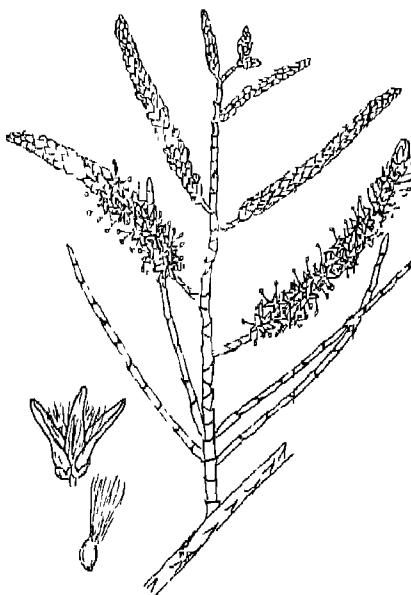


Fig. 4.62 Tamarisk

common on the seashore where it grows to be a bushy tree. It derives its name from the belief of woodcutters that if the



Fig. 463 Blinding tree

extremely acrid juice contained in the stem of this tree enters the eye it can cause blindness.

KUMBI or KUMBHA (*Careya arborea*, Fig. 4.64) is a fire-resistant tree of our forests and is related to the Barringtonia. The simple wavy margined leaves occur clustered at the ends of branchlets. The large creamy-white flowers occur in



Fig. 4.64 Kumbi

terminal spikes. They have numerous stamens spreading like the bristles in a brush. The large fleshy aromatic fruit, each the size of an apple, is edible but poisonous to fish. The wood finds minor uses, the bark yields fibre and the leaves are used for wrapping cheroots and *bidis*.

BARRINGTONIA (*Barringtonia* species, Fig. 4.65) is a tree or shrub usually of mangrove or tidal forests such as in the Sundarbans and in the backwaters as in Kerala. The one known in Hindi and Bengali as *Hijal* (*Barringtonia acutangula*) is however not a mangrove but is found widely in inland forests on

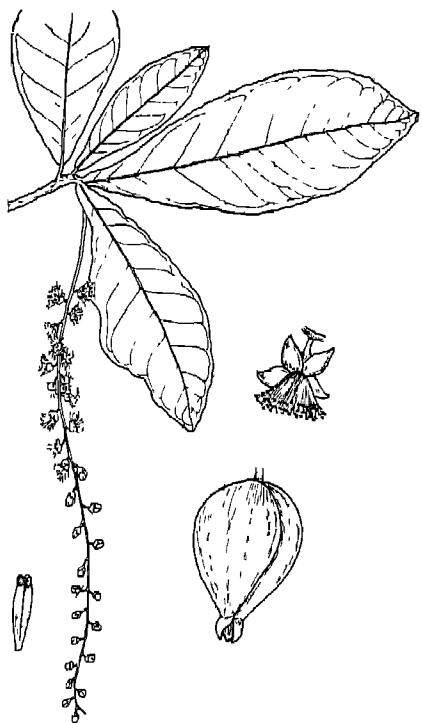


Fig. 465 Barringtonia

the banks of streams and in swampy places. It is also often cultivated in gardens for ornament. It is an evergreen tree with large leathery leaves with rounded tips. The flowers occur in bunches at the ends of branches. The bluntly four-angular fruit crowned by the persistent calyx is suited for wind dispersal. Stamens are numerous. The wood of this tree is said to turn black when buried. It is used for building boats, cabinet making, etc. The bark is used to intoxicate fish and also for tanning. The trees on which the migratory birds nest in the Vedantangal bird sanctuary near Madras are mostly a species of Barringtonia.

The Mangrove family or Rhizophoraceae, with a few exceptions, consists of trees that exclusively grow in sheltered tropical coasts, in creeks and lagoons, near the sea. The family is of unusual interest to botanists because of the several adaptations its members show to life in saline waterlogged soils. Many of them are inherently resistant to the high salt content in the soil which most ordinary trees cannot endure. Species of Rhizophora (Fig. 4.66) develop an extensive system of curved

aerial brace roots that form a scaffold lifting up the crown above the high tide mark. Others develop special breathing roots or pneumatophores which grow upwards against gravity and expose themselves above the soil. The air pores on the surface of these roots communicate through an extensive system of air spaces with the subterranean parts of the tree ensuring them

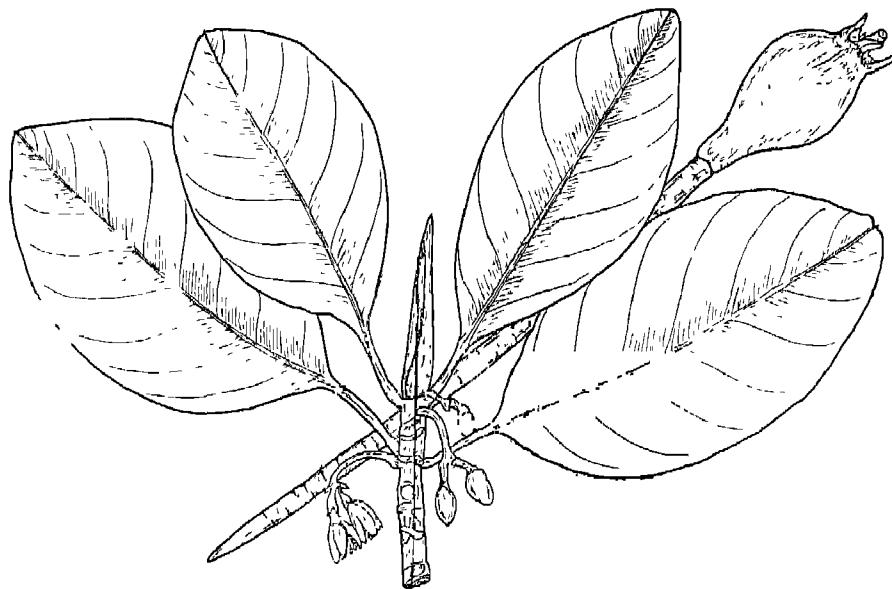


Fig. 4.66 Rhizophora

adequate supplies of fresh air which the waterlogged soil is deficient in. Another unusual feature of some mangroves is the viviparous germination of their seeds. That is, the seeds germinate while still enclosed in the fruit which is attached to

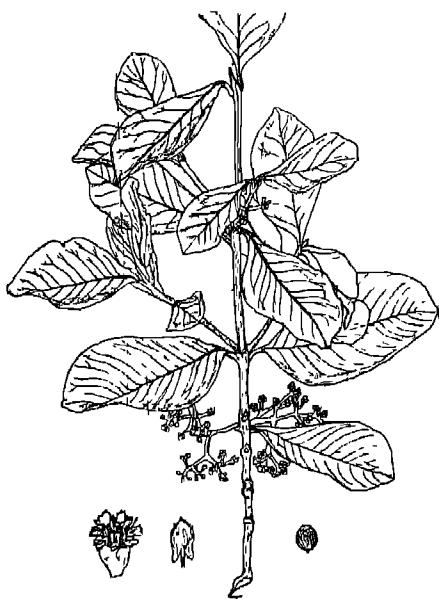


Fig. 4.67 Carallia

WHITE MANGROVE TREE (*Avicennia officinalis*, Fig. 4.68) though a denizen of mangroves, does not really belong to the Mangrove family but is related to the Teak and the Gamari. The underground horizontal roots send up numerous narrow erect conical pneumatophores. The flowers and the fruit are yellow. The seeds are *not* viviparous unlike in many other mangroves.



Fig. 4.68 White Mangrove tree

the parent tree and only later do the pointed young seedlings drop down on the soft mud beneath to get a good foothold and a good start to adulthood.

CARALLIA (*Carallia branchiata*, Fig. 4.67) belongs to the Mangrove family but is not a typical member of it in the sense that it is found far inland, in the evergreen forests of South India, and never on the coast. However, sometimes it does produce aerial roots reminiscent of the more typical aerial ones of its coastal kins.

SUNDRI (*Heritiera minor*, Fig. 4.69) is the characteristic tree of the Sundarbans where it occurs gregariously. It grows to be an evergreen tree with grooved and buttressed stem and inverted tentpeg-like breathing roots such as those of the mangroves. The leaves are leathery and covered with silvery scales beneath. The flowers are small and orange-coloured. The fruit is woody. The wood of this tree is variously used for boat-building, oars, masts, posts and agricultural implements. Even



Fig. 4.69 Sundari

furniture is made out of it and the Sundri is the principal fire-wood source for Calcutta.

WILLOWS (*Salix* species, Fig. 4.70) which are chiefly temperate trees are well represented in the Himalayas. The four-stamened Willow (*Salix tetrasperma*) is the only one that is widely found in the plains occurring along streams and water courses. The Weeping Willow (*Salix babylonica*) is planted in



Fig. 4.70 Willow

cemeteries. The Willows are typically deciduous and in the colder parts of the world where they usually occur they are completely leafless during winter. The leaves are simple and stipulate. They reappear in spring. The flowers are unisexual, the male and female occurring in erect or pendant catkins but on different trees. There are no petals in the flowers. The fruit is a capsule and the seeds have a tuft of silky hair at one end which ensures their carriage by wind. The Willows are easily raised from cuttings and in nature often reproduce by root suckers. The Willow wood is light, both in colour and in weight but is nevertheless strong. Willow is the one best suited for making cricket bats and other sports goods. It is hence introduced and grown in Kashmir where twigs of the Wicker Willow are much used in basketry.

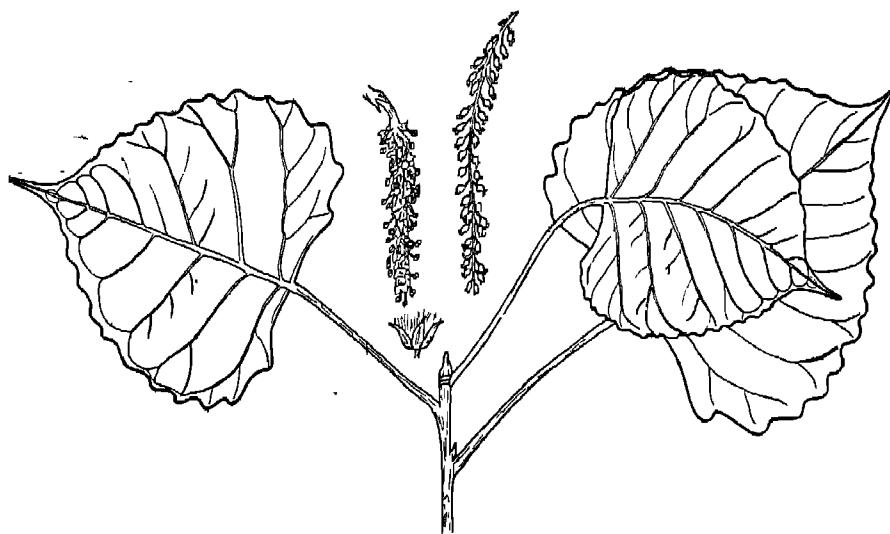


Fig. 4.71 Poplar

POPLARS (*Populus* species, Fig. 4.71) are familiar temperate trees that are closely related to the Willows. In our country, they chiefly occur in the cooler parts of the Himalayas. In Kashmir, for example, they are a familiar sight along avenues, lakes and canals. Like the Willows and Oaks, they are also deciduous and shed all of their foliage in autumn and spend the cold winter completely bare and leafless. The leaves which somewhat resemble those of the *Pipal* are a good fodder for animals. The Poplars are very easily propagated by cuttings and are fast growing. Their soft wood finds many uses.

OAKS (*Quercus* species, Fig. 4.72) like the Willows and Poplars are also natives of temperate climates. In our country, they thrive only in the Himalayas at higher altitudes, where they often form forests mixed with various conifers. The bark of the Oaks is rough and is usually covered with plenty of mosses and lichens. Most Indian Oaks unlike their European counterparts, are evergreen. The Oak leaves can be readily identified by their appearance. They are simple, stiff and leathery, deeply nerved and their undersurfaces are, as a rule, whitish. The Margins are either toothed or are deeply lobed. The male and female flowers are separate but occur on the same tree. The female flower is usually seated singly in a cup made of numerous

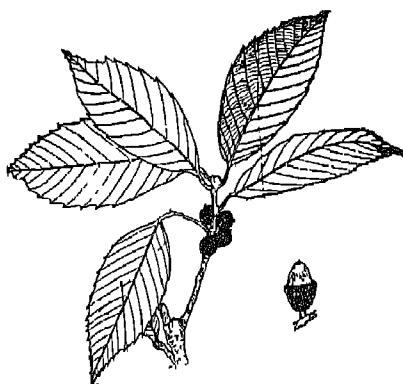


Fig. 4.72 Oak

small over-lapping scales which harden in the fruit. The nut together with this rough cup is called the Acorn of Oak. The Oaks grow slowly and attain a venerable age. Their wood is very hard and durable. In olden days the Oak timber was used in Europe for building ships before the advent of the modern steamers. It is still used in those countries for furniture and for building purposes.

INDIAN CHESTNUT (*Castanopsis indica*) occurs in the temperate Himalayas. Its fruit is edible and is eaten roasted. The wood takes a fine polish and is variously used.

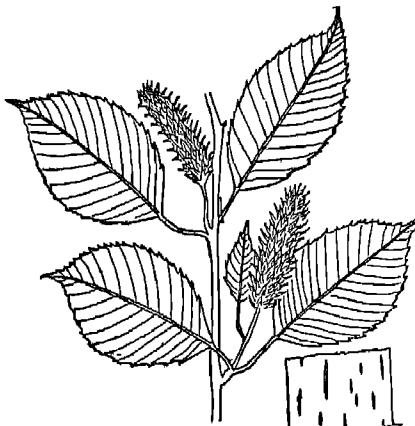


Fig. 4.73 Birch

BIRCHES (*Betula* species, Fig. 4.73) occur exclusively at higher elevations of the Himalayas. They are characterised by the peeling bark. The smooth shining white or pinkish-white papery layers of the bark of one of our Himalayan species, *Betula utilis*, peels off in broad horizontal rolls. Known as *Bhojpattara*, these were once used as paper to write upon.

THE EASTERN PLANE TREE or CHINAR (*Platanus orientalis*, Fig. 4.74) is an all too familiar tree of the Kashmir valley, where it was introduced by the Mughal emperor, also frequently planted in Punjab. It can grow to a 100' and attain great age. The Kashmiris hold it in simple palmately lobed leaves are very characteristic which is deciduous and leafless in winter but

the year casts a cool and inviting shade. The bark peels off in large flakes. The flowers are unisexual but the male and female are borne on the same tree in separate globose heads. The female heads ripen into a round ball of one-seeded fruit. The

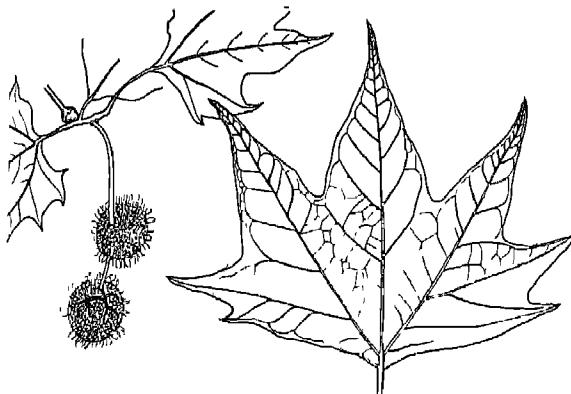


Fig. 4.47 The Eastern Plane tree

Chinar can be easily propagated by cuttings. Its light wood is used for making fruit boxes and small fancy articles. The dried leaves of the tree collected after the leaf fall are used for heating the fire pots (*Kangaris*) of the Kashmiris.

INDIAN ALDERS (*Alnus nepalensis*, *A. nitida*) occur in the temperate Himalayas. Their wood is of limited value for tea chests, etc.

HIMALAYAN MAPLE (*Acer oblongum*, Fig. 4.75), unlike many European and American Maples and the related Sycamors,

has simple pinnately veined leaves. The fruit, however, is like that of all other species, namely, a two-winged, two-seeded samara.



Fig. 4.75 Himalayan Maple

APPLE (*Malus pumila*) and PEAR (*Pyrus* species), PEACH and ALMOND (species of *Prunus*), and other temperate fruit trees are cultivated in the Kashmir valley and in Himachal Pradesh, besides a few other suitable areas in the mountains.

The Pear and Peach are also planted sometimes in the northern plains along avenues and in gardens, the latter more for its beautiful blossoms than for its fruit which is of an inferior quality compared to that grown in the mountains.

The Rhododendrons are mostly shrubs of higher elevations of especially the Eastern Himalayas. But the Rhododendron tree (*Rhododendron arboreum*) is a fairly common tree of the Western and Eastern Himalayas at comparatively low elevations. You can see the large beautiful crimson bunches of its flowers if you visit Simla, Mussoorie or other hill stations during March-May. The Nilgiri Rhododendron (*Rhododendron nilagiricum*) occurs in the mountains of South India.

Trees with Compound Leaves

The *Neem* or Margosa trees are characterised by pinnately compound leaves. With exceptions such as the Tun, the stamens in the flower are all united in a tube that loosely encloses the style and stigma. A number of trees of this family are economically useful to us in various ways.

THE MARGOSA or NEEM TREE (*Azadirachta indica*, Fig. 4.76A) is familiar to everyone on account of its proverbial bitterness and good medicinal properties. In Sanskrit it is known as *Nimba*. The tree is very often planted near villages and along roads. It thrives well in dry climates. The *Neem* is a medium-sized or large tree, mostly evergreen and with a dark, rough bark and reddish wood. The leaves of this tree are very distinctive. Arising crowded near the ends of the branchlets, they

are imparipinnate compound with an odd number of curiously shaped oblique curved leaflets with toothed edges and pointed



Fig. 476 A. The Margosa B. Persian Lilac
C. Toon

tips. The small scented pale-yellowish flowers arise in large numbers in drooping axes from the leaf axils. A conspicuous

feature of the *Neem* flower is the tubular funnel formed of the fused stamen filaments and enclosing the pistil. Bees and other small insects are attracted by the delicate scent of the flowers and buzzing swarms of them can usually be seen hovering around the tree all through the flowering season. The fleshy fruit is yellow or purple with a seed-containing stone within.

It is said that nothing can be more bitter than the *Neem* and yet this tree finds many medicinal uses and the belief seems to be prevalent that the more bitter it is the better its medicinal virtues. The bitter young leaves are eaten (usually with Jaggery to allay the bitterness) on the Hindu New Year's day to ward off sickness during the coming year. The leaves are festooned across houses where there is an epidemic of smallpox. They are also crushed and used in the paste or poultice form to heal smallpox and other wounds. Dried leaves put in drawers and cupboards keep out cloth-eating moths, cockroaches and other insects. The twigs are used as toothsticks. Young leaves and flowers are cooked and eaten. The seeds on crushing yield the famous Margosa oil so effective in the treatment of leprosy and skin diseases. It is also used for making soap and for burning. The residue or cake left after the oil has been expressed from the seeds is used as a manure in keeping white ants away from the plants in the ground. The bark and gum also yield valuable medicines and, in short, every part of the tree is valuable. The *Neem* timber is hard and heavy and no insects will attack it. It is used for bullock carts and other purposes.

PERSIAN LILAC or BEAD TREE (*Melia azadirach*, Fig. 4.76 B) is a tree closely resembling the *Neem* in appearance. The leaves are much like those of that tree, but a closer examination

reveals distinct differences. They are bicompound at the base and the leaflets are not curved like a scythe as in the *Neem*. The flowers, more especially their stamen tubes, are purple in colour, not pale-yellow as in the *Neem*. The fruit contains five seeds which, having a natural perforation through the centre, make ideal beads and are strung into rosaries and necklaces. The tree is widely grown as an ornament and is found in Kashmir and sub-Himalayan tracts. It grows very fast attaining up to 12 metres in height in a few years. The wood is variously used but is not very valuable.

A number of other trees belonging to the same family as the *Neem* and Bead trees occur in our forests and many of these yield valuable timber. The Toon or Red Cedar (*Toona ciliata* Fig. 4.76C), the Hill Toon (*Toona serrata*), the Satinwood (*Chloroxylon swietenia*), the Chikrassy or Chittagong wood (*Chukrasia tabularis*), the White Cedar of Malabar (*Dysoxylum malabaricum*), Rohituka (*Aphanamixis polystachya*) are some of them. The Mahogany (*Swietenia mahagoni*, *S. macrophylla*) of the West Indies, one of the best cabinet woods, is also grown in some parts of our country. Some of the aforementioned trees have capsular fruits which burst open unlike those of the *Neem* and contain winged seeds within.

Quite a number of our native and introduced trees belong to the Legume family, one of the largest families of flowering plants. To the same family also belong the pulses and related forage plants which are of great economic value. Members of this great group are easy to recognize. They bear compound leaves (Bauhinias are a notable exception, see page 78) and a distinctive kind of fruit called the legume or pod. In their

roots occur nodules which enrich the soil converting the free elemental nitrogen of the atmosphere into nitrogenous salts which most plants can absorb only through their roots. Hence the added value of leguminous crops in rotation practices in agriculture.

Depending upon the flower structure three subfamilies (sometimes separated as distinct families) of legume-bearing plants are recognized. The Tamarind, the Cassias, the Asoka, the Hardwickia, the Malabar Mahogany, the Acrocarpus, etc., and the introduced Flambuoyant tree and the Colville's glory represent one of them. To the Pea subfamily characterized by its distinctive corolla (described on page 40) belong the Pongam, the Flame of the Forest, the Coral trees, the Rosewood, the Red Sanders and many others. The third subfamily is well exemplified by all Acacias including the *Babul*, the *Siris*, the Coralwood tree, the Mesquite, the Rain tree and so on.

TAMARIND (*Tamarindus indica*, Fig. 4.77) derives its name from the Persian Tamar-i-Hind meaning in that language the Date of India. Originally a native of tropical Africa, it is now widely planted and naturalized everywhere in the tropics of both hemispheres. It is planted and run wild near villages in our country. The Tamarind groves in forests often mark the site of deserted cultivation or village. The tree is also planted along avenues, in parks and gardens. The Tamarind is a medium-sized tree with a short strong trunk and a spreading crown of branches. The thick bark is almost black and covered with vertical fissures and horizontal cracks. The tree is never wholly leafless. The leaves are pinnately compound with 10-20 pairs of small leaflets which generally recall the branches

bearing the simple leaves of the Indian Gooseberry or *Aamla*. They are oblong, smooth and grow at an angle. The small scented flowers are variegated yellow and red. They are attractive to look at but are usually inconspicuously lost amidst the foliage. Only three petals and three stamens are developed in each flower. The pods are flattened and very considerably in size and shape. Many are sickle-shaped, constricted at intervals some like long thick beans and others nearly as short as their breadth. They are at first green but a thick felt-like film on the green makes them appear brownish. When ripe, they

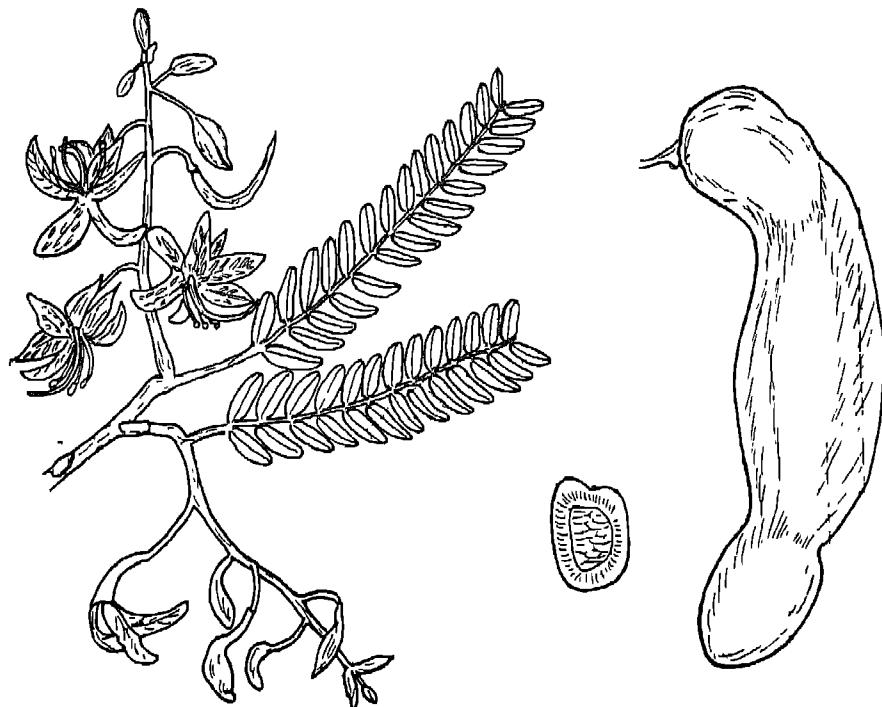


Fig. 4.77 Tamarind

are stiff and brittle. The dark, smooth, shiny, flat seeds are enclosed in a brown and sweetly acid pulp which is the most valuable part of the Tamarind fruit, of which the reddish-pulp varieties are considered the best.

The Tamarind is used for various culinary preparations especially for curries and chutneys all over India. It is an almost indispensable ingredient of the *rasam* and *sambhar* of the South and the *Gol gappa* of the North. The leaves and flowers are also eaten, the former making a good poultice as well for boils and formerly used for imparting a green colour to cloths dyed previously with Indigo. The hard wood is used for making wheels, mallets, oil presses, rice-pounders, etc.

THE INDIAN LABURNUM, AMALTAS or KONNAI (*Cassia fistula*, Fig. 4.78) is one of our loveliest native flowering trees. It occurs wild in drier forests and is also widely planted. The bark is smooth and grey or greenish-grey on young trees. During the hot season when the tree is mostly leafless it is profusely covered with long pendulous racemes more than 30 centimetres long and bearing rich golden-yellow flowers on long slender stalks. The Sanskrit name *Suvarnaka* is therefore quite an apt one. Three stamens in every flower are the tallest and along with the green style they gracefully curve upwards. Anthers are brown in colour and of different sizes. New leaves are in lovely tender green sometimes tinged with pink or rich copper colour. After the last blooms have withered, the long stick-like cylindrical pods hang down. Soft and green at first, they turn brown and eventually black and hard. The seeds lie embedded in a sweet laxative pulp which monkeys, bears and insects greedily feed upon.



D. Schermer
1960

Fig. 478 The Indian Laburnum

Besides its great ornamental value, this native tree finds many uses. All parts of the plant are medicinal. The dark-brown pulp of the fruit in which the seeds are embedded, is a laxative in smaller doses and a purgative in larger ones. In Bengal it is also used for flavouring tobacco. The bark is used for tanning. The wood which is hard and durable is put to many odd uses in villages. It makes an excellent fuel and gives good charcoal.

SIAM CASSIA, MANJA KONNAI or KASSOD (*Cassia siamea*, Fig. 4.79) is naturalized in the South and is cultivated throughout India as an ornamental tree for its large bunches of yellow flowers. It is much used in the afforestation of eroded lands particularly in dry zones. The Pink Cassias (which will be considered later), the Tanner's Cassia or Aavaram (*Cassia auriculata*) shrub of South and Central India and many other herbaceous weedy Cassias all belong to the same large genus Cassia.

ASOKA (*Saraca asoca*, Fig. 4.80) is another of our beautiful native trees that finds praiseful mention in our ancient Hindu and Buddhist scriptures. According to the *Ramayana*, Sita after being abducted by Ravana spent her days grieving for Rama amidst a grove of Asoka trees (*Asokavana*) in Lanka. A quaint Hindu belief still has it that the trees will flower only in places trodden upon by a woman's foot. Another asserts that an Asoka tree will bloom more vigorously if kicked by a young lady. The Buddha is supposed to have been born under an Asoka tree, according to one belief. As to why this tree is called Asoka which means "the Sorrowless" is difficult to understand particularly because Sita had more than her share of sorrow, and the Buddha had to ply through the sea of sorrows before attaining enlightenment.

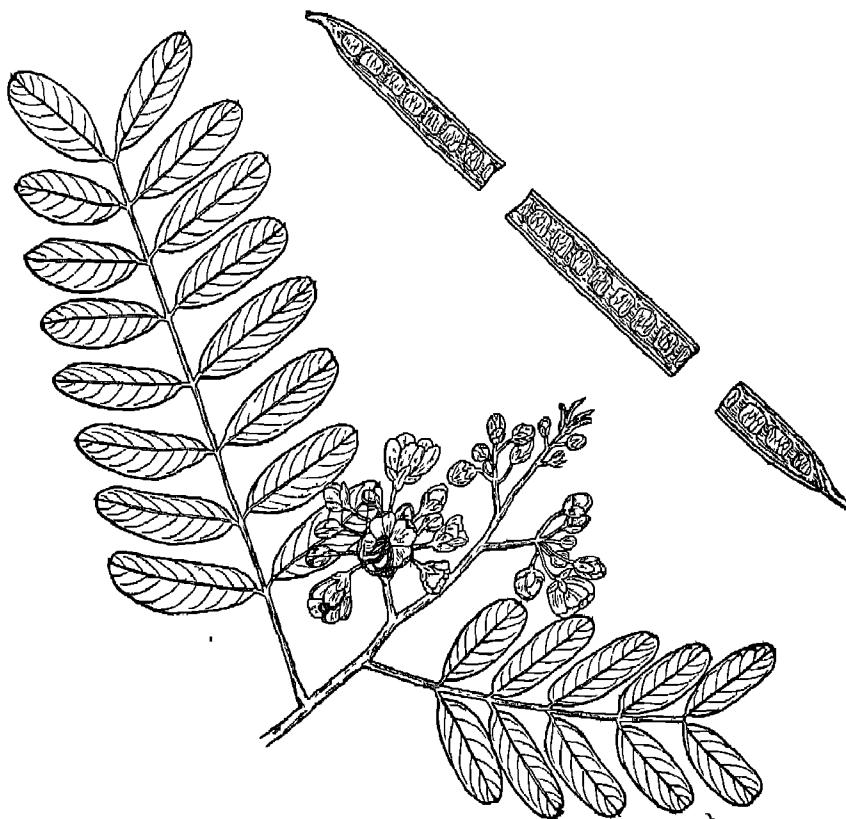


Fig. 4.79 Siam Cassia

There is an obscure tradition of Indian ladies drinking the water in which Asoka blossoms have been immersed, in order to protect their children against sorrow and suffering. This might well be the basis for the name. The tree is also associated with chastity, Sita taking refuge in a garden of Asoka trees being of significance in this regard.



Fig. 4.80 Asoka

The tree is evergreen with a smooth bark, a compact shapely crown and long smooth shining compound leaves. It is found wild in evergreen forests of the Western Ghats and Assam occurring mainly along wide streams. The young leaves are reddish and remain limp and pendant for some time. The flowers arise in profuse clusters. They are yellow when young but turn orange and crimson with age and exposure to the sun. Each flower has a long tube from the ringed summit of which arise the long coloured stamens giving a hairy appearance to the flower clusters.

Besides being a very ornamental tree planted in gardens and for religious purposes, the Asoka is put to some other local uses. Extracts from the bark are used to cure certain ailments of women. Pulp from the blossoms is one of the remedies for dysentery. On the *Ashok Shasthi* day women from Bengal eat the flower buds.

HARDWICKIA or ANJAN (*Hardwickia binata*, Fig. 4.81) occurs in isolated patches in the drier parts of South and North India. Its leaves are small and Bauhinia-like but completely cleft

down the middle into a pair of leaflets. Pods are flat and somewhat recall those of the Rosewood. The wood is one of the hardest and heaviest of native timbers. Hence its use for bridge and house construction, for agricultural implements, carts, etc. A strong rope fibre is also extracted from the inner bark and the branches are lopped for manure and cattle fodder.



Fig. 4.81 Hardwickia



Fig. 4.82 Malabar Mahogany

MALABAR MAHOGANY TREE (*Kingiodendron pinnatum*, Fig. 4.82) of Kerala and Coorg bears 4-7 large leaflets in each of its compound leaves. Its timber is durable and used for furniture, etc. A resinous balsam is also tapped from the heart-wood.

ACROCARPUS (*Acrocarpus fraxinifolius*) is a giant tree of

the rainforests of the Western Ghats, Assam and parts of Bengal. It is a very large deciduous tree with large buttresses at the base. The leaves are bipinnate compound. The timber known as Mundani in the trade is useful and the tree is also grown for shade over coffee bushes.

PONGAM (*Pongamia pinnata*, Fig. 4.83) occurs wild in forests, especially by streams and rivers. It is also extensively planted. The tree is medium-sized and fast-growing with a rough



Fig. 4.83 Pongam

greyish-brown bark. The evergreen leaves form a nice spreading crown and the shade of the Pongam tree is considered especially cooling. Each leaf is pinnately compound usually with five large

shining leaflets, the odd terminal one being the largest of all. The small pinkish-white flowers arise in racemes half hidden amidst the foliage. Falling away before they wither, they carpet the ground below. The pod is short, flat and keeled, about five centimetres long and when at length they dry and fall, the ground is covered with a crackling carpet.

From the seeds of the Pongam is extracted the red pongam oil used for burning and also for skin diseases. It can also be used for making soap and has antiseptic properties. The juice of the roots is applied to sores and is used for cleaning the teeth. To ensure a clean bole, the tree is usually lopped, the loppings being given to cattle or ploughed into rice fields as manure.

THE FLAME OF THE FOREST or PARROT TREE (*Butea monosperma*, Fig. 4.84) is a native of our land occurring usually in deciduous forests. The battle of Plassey is said to have taken its name from this tree which in Bengali, Hindi and Marathi is known as *Palas* or *Palasi*. The tree usually has a crooked trunk and twisted irregular branches but when it is leafless and in flower from January-February to March-April it is certainly one of our most gorgeous trees, with a riot of orange and vermillion blossoms covering the entire crown and looking truly a tree aflame. The cup-shaped velvety brownish-green calyx is in perfect contrast to the vermillion-red of the petals. The curved keel recalls the curved beak of a parrot. The leaves are compound, each with three large leathery leaflets. The main leaf stalk is swollen at its base. The pods are pendulous and contain flat brown seeds usually only one in each pod. The young pods being green look like foliage at a distance. The flowers are without scent but many kinds of birds visit them

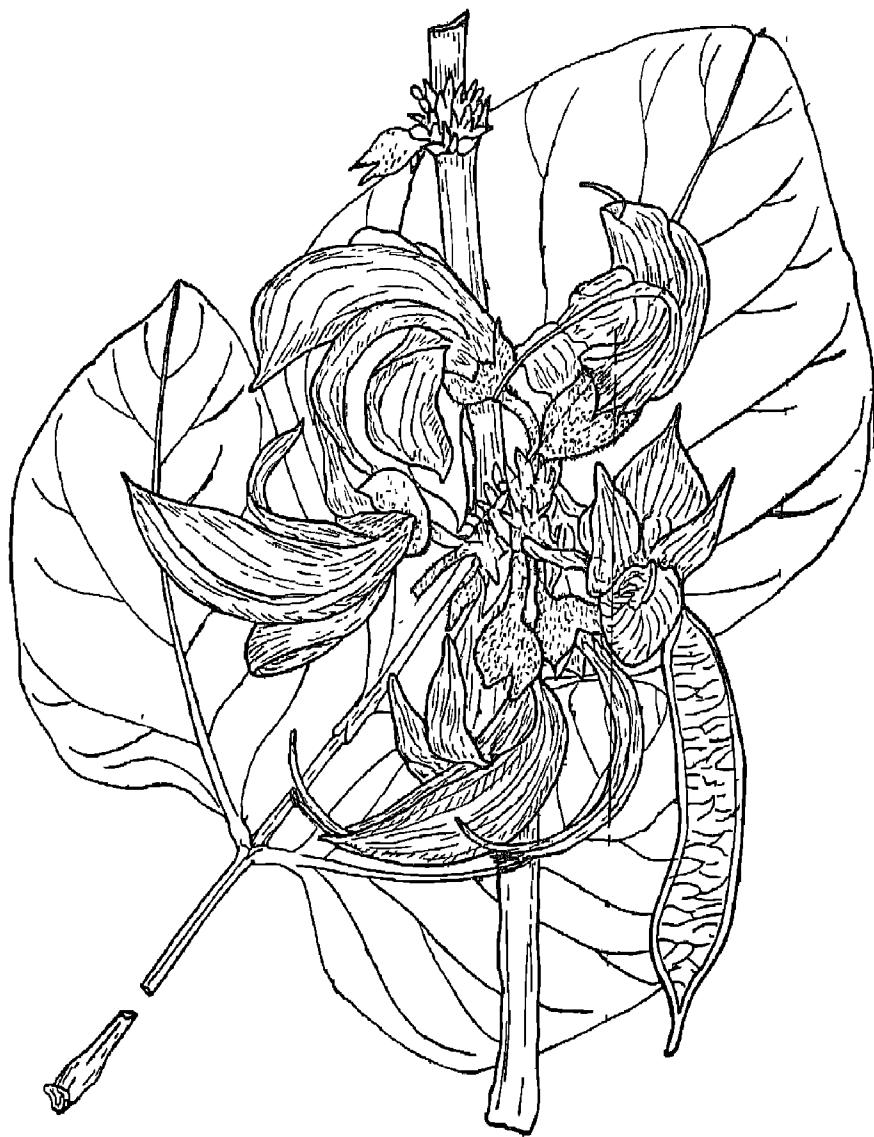


Fig. 4.84 The Flame of the Forest

for the nectar that they contain. Ripe pods are very light in weight and are scattered far and wide by strong winds of the hot weather. The tree finds several local uses. When the tree is in full bloom, a yellow non-permanent dye is made from an infusion of the flowers which is used as *gulal* during the Holi festival. It can also be used to dye cloth. The gum which exudes from the trunk and known as 'Bengal Kino' is medicinal and is also used in tanning leather. The seeds yield an anthelmintic oil. The bark and young roots make a strong coarse fibre. The large leaflets are much used in the South for making round plates by being stitched together by the steams of the broomstick grass. Young leaves are fed to buffaloes. The tree is also one of the principal hosts of the Lac insect. The Palas is sacred to the Hindus. The three leaflets are symbolic of *Trimurti*—the trinity of Brahma, Vishnu and Shiva. A rare yellow-flowered variety is also sometimes found.

CORAL TREES (*Erythrina* species, Fig. 4.85) of many kinds occur wild in different parts of our country. Many of them are widely planted for shade and as ornamentals because of their angular spikes of rich, red blooms. These make their stately appearance amongst the naked leafless branches about the same time as the Red Silk Cotton tree is also in bloom but can be distinguished by the deep-red colour of the flowers and from the fact that they arise in tapering spikes and not solitarily. Villagers plant the Coral trees in hedges. They root easily from cuttings. The Corals are usually small prickly trees, a few mere shrubs, with deciduous compound leaves, each leaf with three large leaflets, the terminal leaflet being the largest. The branches and young trunks are covered with conical prickles like those

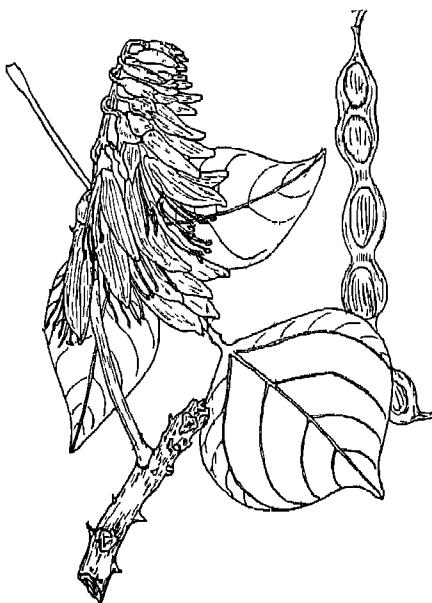


Fig. 4.85 Coral

first turn black on maturing. They contain smooth red or purple egg-shaped seeds. The latter one when rubbed on a stone becomes hot and causes a burning sensation when touched on the skin.

SISOO or NORTH INDIAN ROSEWOOD (*Dalbergia sissoo*, Fig. 4.86A) of the timber trade, is a gregarious deciduous tree abundantly found in the riverain alluvial soils of the sub-Himalayan tracts. It is also widely planted elsewhere in North India as a roadside tree. The Sissoo has a thick and longitudinally furrowed bark. The leaves are pinnately compound and the leaflets are rounded in outline but with a pointed tip. During spring,

of the Red or White Silk Cotton trees. The calyx is either sheathing and splitting irregularly or is two-lipped. The petals are an erect standard, two small wings and the two lowest forming a boat-shaped keel. Although the flowers have no scent, they are very popular among birds which seek their nectar. Crows, Mynahs, Parakeets, Babblers and various other birds as well as bees, and wasps noisily swarm round the tree when it is in bloom making it look like an aviary. The ground below is littered with the remains of their activity. The pods which are green at

the tree produces a profusion of small fragrant cream-coloured flowers. The fruit is a thin strap-shaped pod with its thin edges extended as wing-like expanses. The seeds are also flattened. The timber of the Sissoo is very durable and seasons fairly well. It is excellent as a furniture wood and for carving, being much used for these and other purposes in North India.

ROSEWOOD or THE BOMBAY BLACKWOOD (*Dalbergia latifolia*, Fig. 4.86B) which is the real Rosewood, is far superior to that of the Sissoo described above. It is more commonly found in the South where the trees attain their largest dimensions in the forests of the Western Ghats. The leaflets of this species are either rounded or cleft at the tip unlike those of the Sissoo, and the fruit is broader than that of the Sissoo species. The timber is dark-purple with black or red stripes and takes a beautiful polish. It is very hard, close grained, very durable and one of the most handsome of furniture woods.

In the genus *Pterocarpus* the following three species are useful timber trees.



Fig. 4.86 A. Sissoo
B. Rosewood



Fig 4.87 A. Kino tree
B. Andaman Padauk

KINO TREE or BIJASAL (*Pterocarpus marsupium*, Fig. 4.87 A) is a widespread tree of deciduous forests. Its hard timber is used for furniture, contructional, agricultural and railway purposes. Besides, it gives a red gum resin known as Kino which is much used in the indigenous medicine.

ANDAMAN PADAUK

(*Pterocarpus dalbergioides*, Fig. 4.87B) is common in the Andaman Islands where it attains very large dimensions. The hard timber is used for a large number of purposes. It varies in colour from light-brown to a gorgeous red. It is a highly priced furniture wood.

RED SANDERS (*Pterocarpus santalinus*, Fig. 4.88) is confined only to a small area in Andhra Pradesh and adjoining parts of Tamil Nadu. The dark-red or almost black heart-wood of this tree has been traditionally used for making dolls of Tirupati. It is also used in villages for houseposts and for carvings. It also yields a pink dye. A special curly grain quality of wood of this tree is, of late, proving very valuable for export to Japan where, because of its unusual acoustical properties, musical instruments such as the *Shamisen* are made of it.

SANDAN (*Ougeinia dalbergioides*, Fig. 4.89) derives its

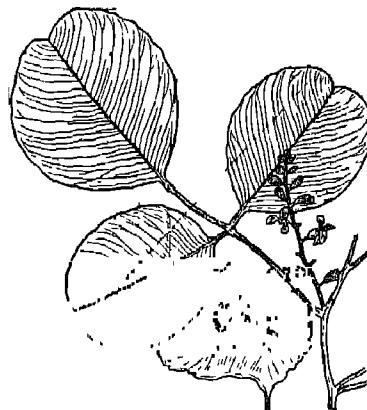


Fig. 4.88 Red Sanders

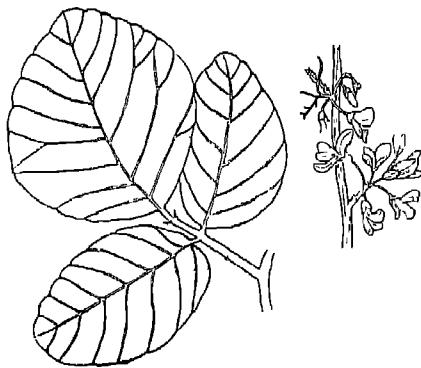


Fig. 4.89 Sandan

tree is leafless. Young leaves are lopped from the tree as fodder and the timber is useful.

AGASTA (*Sesbania grandiflora*, Fig. 4.90) is often cultivated in gardens, betel nut plantations and homeyards in the South for its large bilipped showy flowers which as also the tender leaves and pods are eaten as a vegetable. The leaves are paripinnately compound, the leaflets with a mucronate tip. Sesban (*Sesbania aegyptiaca*), a shrubby relative, is widely used to make hedges.

SIRIS, EAST INDIAN WAL-NUT or KOKKO (*Albizia*

generic name after Ujjain in Central India. It is, however, widespread over the entire country and is very common in the Sal forests of Uttar Pradesh. It is a moderate-sized tree with a crooked stem. The bark bears regular longitudinal and horizontal cracks peeling off in regular flakes. The pink flowers are produced in dense fascicles from the old wood usually when the



Fig. 4.90 Agasta



Fig. 4.91 A. Siris
B. Black Siris

lebbeck, Fig. 4.91A) of the timber trade all refer to one and the same tree species which and its many near relatives such as Black or *Kala Siris* (*Albizia odoratissima*, Fig. 4.91B), White or *Safed Siris* (*Albizia procera*) and *Siran* (*Albizia chinensis*) occur in our forests or are often cultivated as ornamentals or for shade along avenues and in coffee and tea plantations. Many of them are unarmed trees with bipinnate compound leaves. The White *Siris* has a distinctly light yellowish bark which makes it easy to recognize in the forest or elsewhere at a distance. The leaves of *Siran* have large stipules at their bases. The fragrant flowers usually occur in globose heads. The long, slender, silky stamen filaments are united at the base and tipped with very minute anthers. Pods are flattened. *Kokko* is an especially valuable timber of this group.

CORALWOOD TREE or RATANGUNJ (*Adenanthera pavonina*, Fig. 4.92) is often planted as a roadside tree in South India. It is a deciduous tree with bipinnate compound leaves. The small fragrant yellow flowers arise in elongated cylindrical spikes. The flat pods burst open when dry and curl up inextricably, those of each spike forming a dark twisted mass against the background of which the attached bright scarlet-red seeds appear very striking. Biconvexly compressed and closely resembling *Ratti* seeds (which belong to a slender climber of the Pea sub-family) they can be distinguished from the latter in being uniformly scarlet without a black spot. Known as Circassia seeds, they are used as a jeweller's weight (each seed approximately weighing four grains) like those of the real *Ratti* unlike which however they are not poisonous, in fact being eaten sometimes. They are also made into rosaries and ground with borax

to form a useful cement. The coloured wood is powdered and used for applying *tilak* and caste marks. It also gives a dye. The timber is employed for building and cabinet making.



Fig. 4.92 Coralwood tree

Acacia is a very large genus of its family to which belongs the Babul and numerous other useful species.

BABUL (*Acacia nilotica*, Fig. 4.93A) is a very familiar thorny tree of the drier parts of the country where one often finds rows of them planted to demarcate one field from an adjoining one. It is a small- or medium-sized almost evergreen tree with a spreading

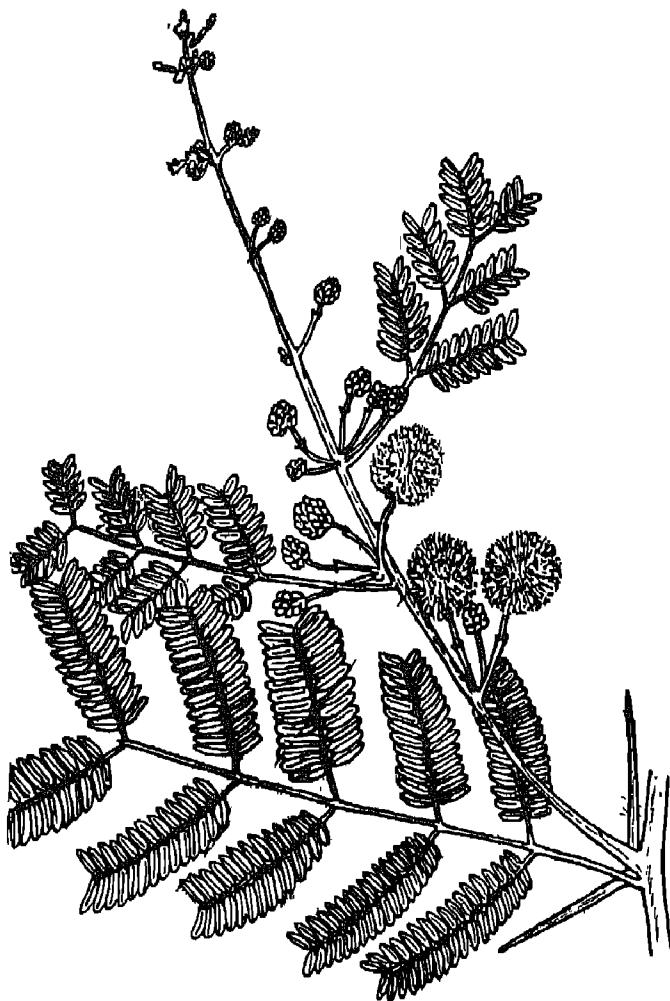


Fig. 4.93 A. Babul

crown, greyish-green foliage and ash-coloured rough bark. Young trees are armed with strong straight whitish spines that may each be as long as five centimetres. These spines occur in pairs at the base of the leafstalk and are absent from old trees. The leaves are bipinnately compound with numerous small leaflets. The minute flowers occur compacted in fragrant golden-yellow balls. The fruit is a grey velvety pod constricted bead-like between the seeds. Three varieties of the *Babul* are usually recognizable, the typical one being called the *Telia Babul*. The *Kauria Babul* is a stunted crooked variety with interlacing branches. It is found on very poor soils. The *Ramkanta Babul* is a tall one with broom-like ascending branches and very ornamental in appearance.

The *Babul* is a very useful tree particularly in drier places where it occurs abundantly and where other trees are usually few. Pods, seeds and tender branches are used as fodder for cattle, camels and goats when grass is scarce. Most parts of the tree have medicinal properties. The bark is used for tanning and a large quantities of it are consumed in the tanneries of Kanpur. It is also used in dyeing. The gum that exudes from this tree is a substitute for the real Gum Arabic (from *Acacia senegal* of the arid regions of Rajasthan and adjoining areas, but is largely imported from the Middle East) which is used in medicine, confectionery and textile industry. The thorny branches are much used for fencing fields and the thorns themselves can be used as substitutes for pins in offices but are rather thick. The timber is hard, heavy and durable. It is used for making cart wheels and agricultural implements. It is an excellent firewood and makes good charcoal.

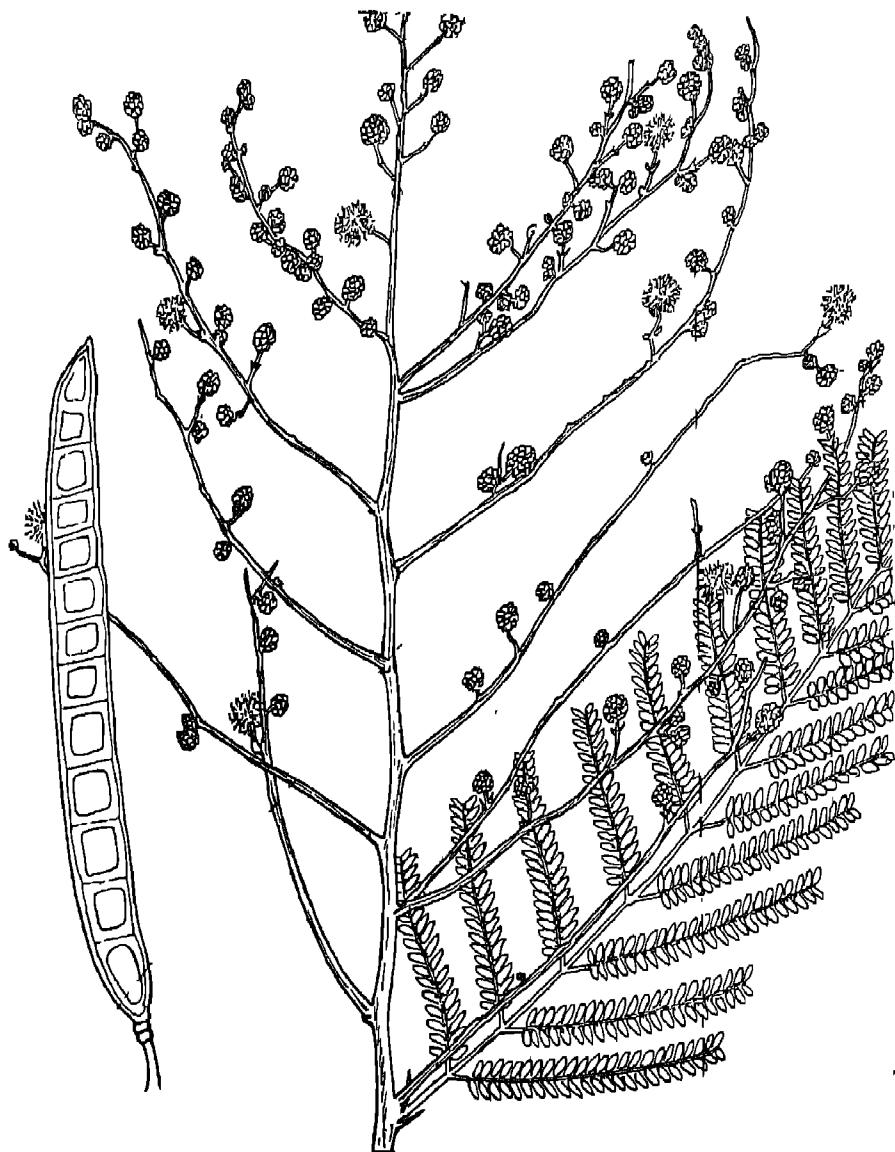


Fig. 4.93 B White-barked Acacia

Besides the *Babul*, many other thorny Acacias form important constituents of our dry thorn forests. Space does not permit mention of all of them but a few. The White-barked Acacia (*Acacia leucophloea*, Fig. 4.93B) is one such common species



Fig. 4.93 C. The Cutch tree

of our dry thorn forests. The Cutch tree (*Acacia catechu*, Fig. 4.93C) occurs widely but unlike the *Babul* bears its flowers elongated spikes. Its thorns are short and curved. The leaf is flattened. From the heart-wood of this tree is extracted

the product known as *Cutch* and *Kattha*. *Cutch* is used for dyeing and tanning whereas *Kattha* is chewed with *Pan*. The

Umbrella Acacia (*Acacia planifrons*) is a noteworthy species of the drier parts of Tamil Nadu, where it is very common on the coastal sand dunes near Rameshwaram. The Fragrant Acacia, Cassie or Sponge tree of America (*Acacia farnesiana*, Fig. 4.93D) is often cultivated (also naturalized) for its very fragrant flowers from which is extracted the Cassie perfume in Southern France. The Soapnut Acacia (*Acacia concinna*) is also a true Acacia but it is not a tree but a thorny climbing shrub from the pods of which is prepared the Shikai

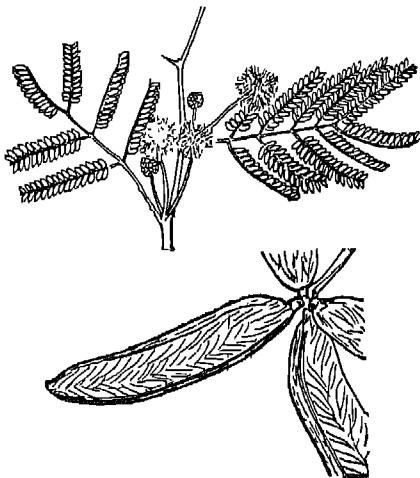


Fig. 4.93 D. Fragrant Acacia

powder, an excellent detergent for the home and indispensable as such for the weekly oil bath of the South Indians. The Wattles and other introduced Acacias we shall consider later.

INDIAN MESQUITE or JHAND (*Prosopis cineraria*, Fig. 4.94) is a very common evergreen spinous tree of the dry and arid regions of Punjab, Rajasthan and Tamil Nadu and elsewhere. It has a spreading crown and bipinnate leaves similar to those of the *Babul* or *Cutch* from which it can be distinguished by the presence of a gland at the tip of each anther of the flower.

The foliage is much lopped for fodder. The tree can also be nicely trained to make spinous hedges for cultivated fields. Belonging to the same genus is the very successfully introduced Mexican mesquite of which we will learn more, later.

MANILLA TAMARIND or PITHECELLOBIUM (*Inga dulcis*, Fig. 4.95) though originally an introduction from Mexico is now run wild and naturalized in various parts of our country. It is common near villages. Allowed to grow freely it attains a tree size but more often it is kept clipped down to form a spiny hedge. The leaves, though compound, have only one pair of unequal-sided leaflets. Stipules are modified into strong thorns. The flowers occur in heads as in the *Babul*. The pods are very distinctive. They are curved in a circle and the seeds are covered with a massive whitish edible aril which monkeys are very fond of.

The following two native trees belong to the Orange and Lemon family—the Rutaceae. Their fruits share two common features—a hard woody rind and pulpy mucilage embedding the



Fig. 4.94 Indian Mesquite



Fig. 4.95 Manilla Tamarind

seeds. The leaves and other parts are dotted with minute glands, as is true of all the Rutaceae in general.

BAEL TREE or VILVA (*Aegle marmelos*, Fig. 4.96) of classical Sanskrit literature occurs wild throughout India in dry hilly places. It is also frequently planted around villages, in homes or near temples. Since it is a sacred tree, its leaves are specially sought for worshipping Shiva. The Bael is a small deciduous tree with a corky bark and with branches armed with strong straight spines. The trifoliate compound leaves are dotted with translucent glands and are aromatic as is so characteristic of the orange and lime family to which the Bael also belongs. The flowers are sweet scented. The large fruit has a woody rind and a sweet orange-coloured aromatic pulp within, in which the seeds are embedded.

The pulp of the ripe Bael fruit is used for making sherbet and marmalade. Unripe and half ripe fruit especially of the wild forms



Fig. 4.96 Bael

is an efficacious remedy for dysentery and diarrhoea. The pulp is also used to strengthen mortar and for mixing with water paints to give a glossy finish and as a substitute for soap. A gum is obtained from the stem. Birds and other animals eat the pulp and help in seed dispersal. The rind of the fruit is

used for snuff boxes. As is true of many other plants, the cultivated tree is less spiny and bears much larger fruit than the wild ones. The wood of the tree is used for agricultural and other implements.

THE WOOD APPLE or ELEPHANT APPLE TREE (*Feronia limonia*, Fig. 4.97) is often cultivated for its fruit. Like the



Fig. 4.97 The Wood Apple

Bael, it is also a thorny tree but its leaves are imparipinnate compound with small leaflets and a winged stalk and axis. Like the Bael fruit again, the Elephant apple has a woody rind which when broken open reveals a round mass of pulp embedding the seeds. Like that of the Bael the pulp is made into sherbet or eaten as such mixed with jaggery. It is also used medicinally for stomach disorders. The hard dry shell of the small fruit is made into snuff boxes. A useful gum is obtained from the stem.

THE CURRYLEAF PLANT (*Murraya koenigii*) is another useful relative of the Bael and Elephant apple. It is a shrub or small tree with imparipinnate glandular, strongly aromatic leaves. This plant occurs abundantly as undergrowth in the Sal and other mixed forests of the sub-Himalayan tracts but its leaves are much more commonly used in the South to flavour *Sambhar* and *Rasam* and is often grown there for this purpose.

ORANGE AND LIME (*Citrus* species) are certainly the two most useful plants of the Rutaceae. Several varieties of them are widely cultivated in subtropical regions the world over. In our country Nagpur, Coorg and Assam are well-known for the Orange while the Lime is grown widely in several varieties, Tamil Nadu supplying a lot of it to other states. The Orange-tree can grow to the size of a small tree but the Lime seldom does so. The Orange, Lime and all its relatives like the Citron, Bitter Orange, *Musambi*, *Malta* and Pummelo or *Chakotra* (*Citrus maxima*) are characterized by a unique type of leaf which to all purposes looks like a simple leaf but is in fact not so. The leaf stalk is often winged.

THE RED SILK COTTON TREE or SEMUL (*Bombax ceiba*, Fig. 4.98) is a typically deciduous tree found all over India,



Fig. 4.98 The Red Silk Cotton

except in the driest areas. It can attain a gigantic size and old trees have plank buttresses to support the trunk and heavy crown. The trunks of young trees are covered with stout conical prickles and the branches arise horizontally in whorls around the main stem. The leaves are digitately compound, 5-7 leaflets springing from the tip of the common stalk much like the fingers of our hand. The very large, bright, scarlet-red (rarely orange or yellow) flowers arise from the naked branches when they are leafless and render the tree very handsome to look at. Each flower has a thick cup-like fleshy calyx, five broad recurved petals, brilliant scarlet and glossy. About 80 stamens occur in five discrete bundles one opposite each petal and an inner bundle of five larger stamens surround the pistil with its long style and coloured five-lobed stigma. Trees in full bloom attract birds of every kind including crows which all visit them to feed on the profuse nectar in the centre of its large flowers. While doing so they pollinate the flowers. The ground below the flowering trees is often littered with several fresh flowers which are fed upon by deer. Village folk too eat the buds and the freshly fallen flowers duly cooked. The torpedo-shaped fruit is woody, velvety outside and when ripe bursts open to expose a fine floss that floats down to earth carrying with it the small black or deep-brown seeds. The soft light wood of the Red Silk Cotton tree is much used for manufacturing match-sticks and matchboxes, for rough planking and for tea chests. The silky floss of the fruit is used for stuffing pillows and cushions although for this purpose it is inferior to that of the White Silk Cotton or the Kapok tree which is known in commerce as the Kapok. Mocharas, a brown astringent gum from



Fig. 4.99 Kapok tree

the Red Silk Cotton tree is frequently sold and is used medicinally against dysentery. The conical prickles on the stem are used for breaking open pimples and boils.

KAPOK TREE or THE WHITE SILK COTTON TREE (*Ceiba pentandra*, Fig. 4.99) which belongs to the same family as the Red Silk Cotton closely resembles it in leaf characters and general growth. The flowers however are different. They are much smaller in size, dirty white in colour and hang down in clusters. This tree is not so widespread as the Red Silk Cotton in our country but the woolly floss of its fruit is of greater commercial value. It constitutes the Kapok or Silk cotton of commerce and is widely used for stuffing pillows, mattresses, etc. The Kapok is light, springy and cannot be easily wetted by water. It is therefore much esteemed for filling life-belts and life-buoys of ships and thus saves many lives during war.

BAOBAB or MONKEY BREAD TREE (*Adansonia digitata*, Fig. 4.100) is yet another member of the Silk Cotton family, Bombacaceae. It is a remarkable African tree with a fantastic growth form. The swollen bottle-shaped trunk which can attain an enormous thickness, tapers suddenly and sends out several thick horizontal branches. It is one of the long-lived trees and hailing as it does originally from Central Africa can thrive in dry desert areas. There are some very large and old trees reported from various parts of our country where it appears to have been introduced in very early times. According to one legend it was Lord Krishna who brought it from Africa and hence the devout hold this tree in veneration. The leaves are digitately compound as is usual with this family. The large handsome but unpleasant smelling whitish flowers bloom about

midnight and fall by morning. They are pollinated by bats. The stamens are borne on a thick stalk forming a globular tassel

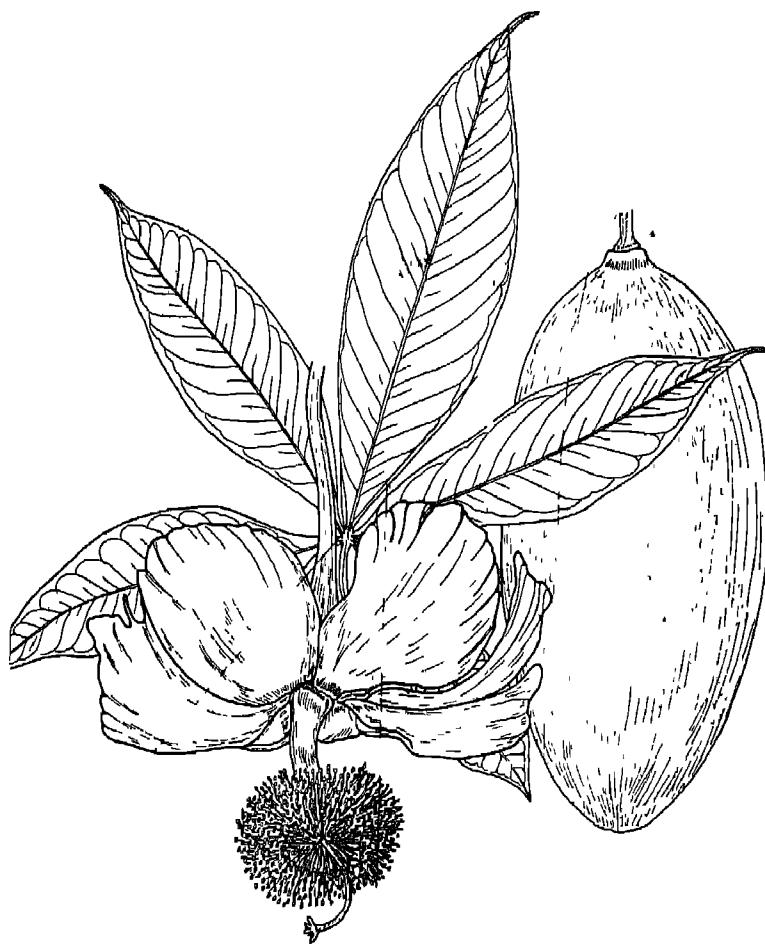


Fig. 4.100 Baobab

to the flower. The large gourd-like fruit has a mealy edible pulp, sour to taste but is much relished by monkeys. The hollowed shells of the fruit are used as floats by fishermen and as vessels by monks. Tribal Negroes of Africa have many uses for this native of theirs including the gruesome one of suspending their distinguished dead in the hollows of old trunks of this tree. But the remarkable fact is that bodies kept thus dry well and are well preserved without embalming. Out of the bark of the tree can be made an extremely strong rope.

WILD ALMOND TREE (*Sterculia foetida*, Fig. 4.101) occurs naturally in Western and Southern India. Its Tamil name *Pinari* meaning 'smelling of faeces'

seems quite appropriate because the flowers of this tree do emit a foetid smell. The tree is a deciduous one and the flowers appear when it is leafless. The long-stalked digitately compound leaves occur crowded at the ends of the branchlets. An oil for burning is extracted from the seeds which are also roasted and eaten in times of food scarcity.



Fig. 4.101 Wild Almond

TREE OF HEAVEN (*Ailanthus excelsa*, Fig. 4.102) occurs wild in South India but is often widely planted in different parts of the country. It is a large deciduous tree with greyish-brown bark, loose clusters of huge pinnate compound leaves recalling those of the Neem but with larger and broader leaflets. Twigs

are thick and marked with large scars of the fallen leaves. The fruit is a small, flat and winged one as in Sissoo with one seed. The tree is chiefly planted for shade. It is a fast-growing tree

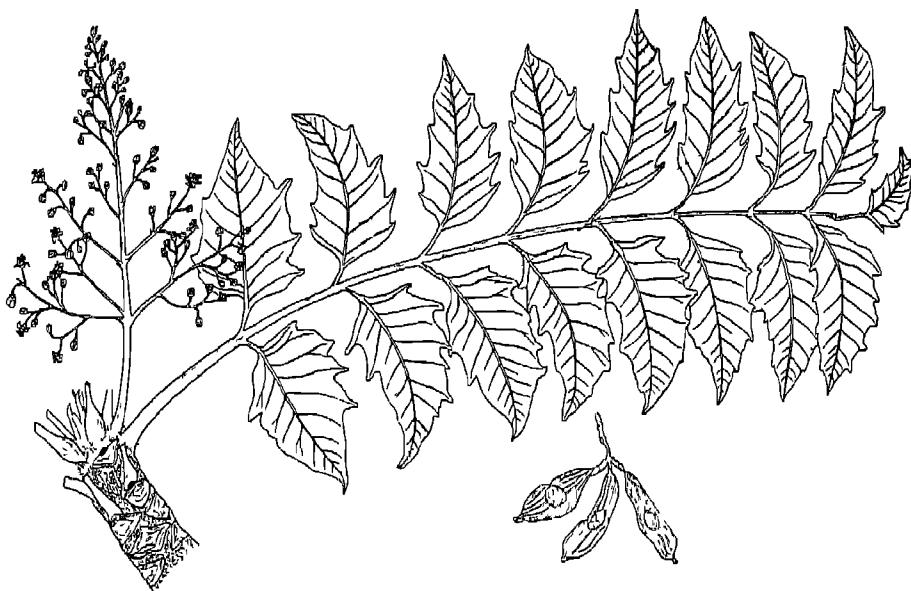


Fig. 4.102 Tree of Heaven

which, in the drier areas, is lopped for fodder. The wood is light and used for a variety of purposes.

THE MATTIPAL TREE (*Ailanthus triphysa*) of Kerala and the Western Ghats is a near relative of the above. It yields a Gum Dammar called Mattipal which is burnt as incense.

INGUDI (*Balanites roxburghii*, Fig. 4.103) also belongs to the *Ailanthus* family. It is a small spiny tree or bush of the drier

parts of the country especially common in black cotton soils. It has ashy green foliage and flowers. The leaves have two leaflets each. The pulp of the fruit is edible and the kernel is rich in oil. Kalidasa describes Shakuntala as treating wounds of her pet deers with this oil. The stones of the fruit are made into crackers by drilling holes in them and filling them with gunpowder. The fruit stones have been found in the ancient pyramids of Egypt.

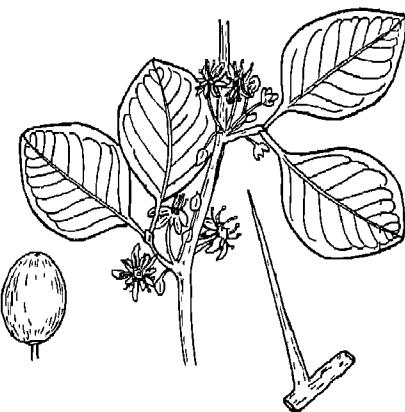


Fig. 4.103 Ingudi

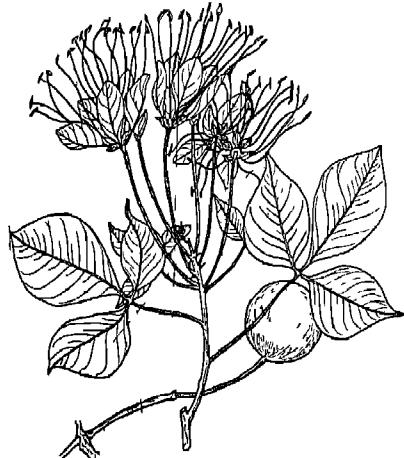


Fig. 4.104 Crateva

CRATEVA or BARNA (*Crateva nurvala*, Fig. 4.104) occurs throughout India. It is often planted for its handsome flowers. One variety of it is especially common in the drier north-western regions of the country. It is a deciduous tree with palmately compound leaves each typically bearing three leaflets. The flowers are large, white, turning to pale-yellow or reddish-yellow in colour as it ages. The ovary of the flower

is borne aloft a long stalk. The fruit is a round hollow berry borne on long stalks. At first it is green but turns scarlet when ripe with woody rind and seeds embedded in the yellow pulp. The wood is of minor value. The leaves, bark and flowers find use in indigenous medicine. The fruit is used to strengthen mortar and in dyeing. The wood is used for making drums, combs and turnery articles.

The following four tree genera belong to the Bignonia family which also includes several climbers. The leaves of the family are compound. The regular or irregular flowers have their petals united with each other to form a long or short tube. The pod-like fruits contain winged seeds.



Fig. 4.105 Indian Cork tree

of the tree is as an ornamental for its drooping blooms of tubular and delightfully fragrant white flowers which are designed to attract moths. The open flowers soon fall off and cover the ground below. The leaves are bi- or triplinately compound,

INDIAN CORK TREE or TREE JASMINE (*Millingtonia hortensis*, Fig. 4.105) is extensively cultivated in India and is run wild in some places. It grows tall and straight and bears a narrow crown of only a few branches. The thick, ashy bark is cracked and furrowed. It can easily be removed and used as an inferior substitute for true cork but the main value

PADRI TREES (*Stereospermum* species, Fig. 4.106) of which there are a couple of species occurring in our deciduous forests, are characterised by imparipinnate leaves. One of them is common in the Sal forests. The fragrant flowers occur in panicles.



Fig. 4.106 Padri trees

The united petals readily fall off as a tube as in most members of the Bignonia family. The timber is hard and finds minor uses. The flowers are used for ornamental purposes.



Fig. 4.108 Wild Tecoma

ULLU (*Oroxyllum indicum*, Fig. 4.107), a small deciduous forest tree, also belongs to the Bignonia family. It is usually found in ravines and other moist places. The leaves are tripinnate at the base, bipinnate in the middle and only once pinnate towards the apex. The tree is conspicuous in the forest when it bears its scabbard-like fruit which breaks open to release its flat, papery and winged seeds. The bark is used for tanning and dyeing.

WILD TECOMA (*Tecomella undulata*, Fig. 4.108) is an important tree of the driest regions of Rajasthan, Haryana, Gujarat

and the outer Himalayas. It is a large shrub or small tree with drooping branches and greyish-green foliage. The bell-shaped flowers are in pretty orange-red. The tree is very useful for afforestation of arid lands. The wood is highly prized for furniture, carving and agricultural implements. The bark is used for tanning and the leaves as fodder for goats.

The following two trees though belonging to the Mango family have compound leaves and are hence treated here.

THE HGPLUM (*Spondias pinnata*, Fig. 4. 109A) is a familiar deciduous tree of our drier forests. It is also frequently

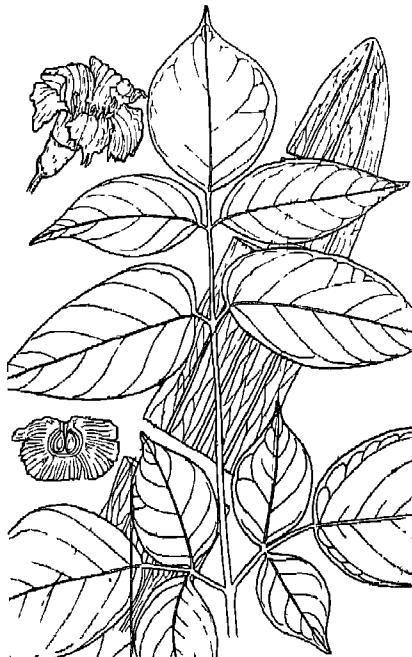


Fig. 4 107 Ullu

planted for its sour fruit which makes excellent pickles. The leaves are imparipinnate compound and the tree remains leafless for a long time during which it flowers. The fruit hangs down



Fig. 4.109 A. The Hogplum

B. The Wodier tree

in pendulous clusters. It is ellipsoidal, smooth and with a hard seed-containing stone within. Wild animals like deer, monkeys and squirrels greedily eat it. The large stones with the flesh eaten away are found scattered about the forest.

THE WODIER TREE or JHINGAN (*Landia grandis*, Fig. 4.109B) occurs in most parts of our country. It is often planted in avenues and used for hedges and boundaries. It is a deciduous tree, completely leafless and bare during the hot season. It has a spreading crown and imparipinnate compound leaves. The small flowers are of different sexes but occur on the same tree. The fruit is kidney-shaped and one-seeded. The wood is locally used for a variety of purposes but is not of any great quality. The gum that exudes from the bark is used as a substitute for Gum arabic. The Wodier is also a good fodder tree for cattle, sheep and goats and especially for elephants. Its bark is also medicinal.

SOAPNUT TREES or RITHA (*Sapindus* species), not to be mistaken for the Soapnut Acacia or Shikai, are so called because



Fig. 4110 Soapnut tree of South India



Fig. 4.111 Soapnut tree of North India

their fruit lathers freely with water like soap and is used as such for cleaning jewels, hair and fine clothes. The fruit kernels are medicinal. The Soapnut tree of South India which occurs widespread there in the deciduous and drier evergreen forests is *Sapindus emarginatus* (Fig. 4.110). It has shiny grey bark and paripinnate leaves, the leaflets slightly cleft at the apex. The three distinct lobes of the fruit which are at first covered with a rusty down become much wrinkled when dry. The seed is black, globular and very hard. The fruit of *Sapindus laurifolius* which occurs only in South India is also used as Soapnut. The Soapnut of the North, *Sapindus detergens* (Fig. 4.111) is usually found cultivated. Its fruit does not show the lobed condition because, of the original three lobes in the ovary, only one develops into the fruit, the two undeveloped ones appearing like mere appendages on it.

KUSUM or LAC TREE (*Schleichera trijuga*, Fig. 4.112) is another valuable plant of the Soapnut family. It is the best species for rearing the lac insect. It is a deciduous tree with compound leaves bearing 2-4 pairs of leaflets.

DODONAEA, VILAYTI MEHNDI or BANJRI (*Dodonaea viscosa*), another member of the Soapnut family, is usually a mere shrub or dwarf tree occurring often gregariously in the dry areas throughout the country. It makes an excellent, evergreen, non-spinous hedge plant in places where rainfall is low. Its linear leaves are covered with a shiny resinous layer.

THE FERN-LEAF TREE (*Filicium decipiens*) occurs in the Western Ghats. It is also planted in gardens in the South for its elegant fern-like compound leaves which have broadly winged axes.

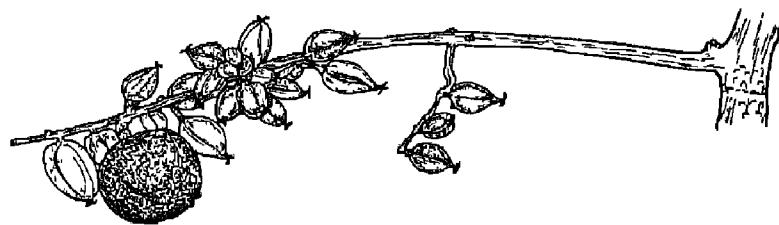
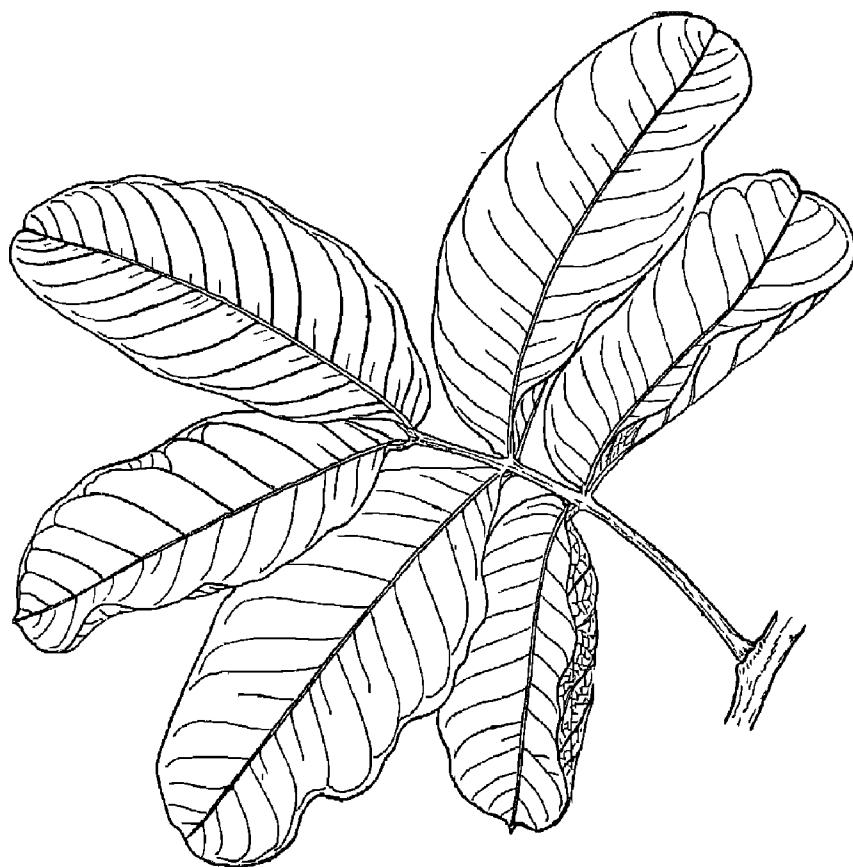


Fig. 4112 Kusum

The Burseraceae are a family of resinous trees with pinnately compound leaves which recall those of the Neem family. The following are some of the more familiar examples of trees belonging to this family.

THE INDIAN OLIBANUM TREE, SALAI or SALLAKI (*Boswellia serrata*, Fig. 4.113A) of Sanskrit literature occurs very widely in the drier forests of the country. A near relative of it finds mention in the Bible. It is especially abundant in the forests of Central India. It is a small resinous tree easily recognizable in the forest on account of its papery bark which peels off in squarish strips. The leaves are pinnately compound and the fruit 3 or 4 angled. The timber of this tree is put to a variety of minor uses. The gum resin that exudes from its trunk and commonly known as Guggal is burnt as incense and used in indigenous medicine for making ointments for rheumatism and other complaints. After fractionation it can be used for varnishes, etc., much like turpentine.

Of other useful trees of the Olibanum family the following may be mentioned. The Resin of the Black Dammar (*Canarium strictum*) of the Western Ghat forests is used locally like that of the Indian Olibanum. The Garuga (*Garuga pinnata*) is a common associate of Teak and Sal in the mixed deciduous forests. The branches of this tree are often seen covered with red galls. The Indian Bdellium (*Commiphora mukul*) is a stunted tree or bush of the arid tracts of Rajasthan and adjoining areas as well as parts of the Deccan. It is sometimes planted for hedges. Its gum resin is the Indian Bdellium used as incense, in perfumery and in medicine. *Kiluvai* (*Commiphora caudata*, Fig. 4.113B) is often planted in South India for avenues. It can

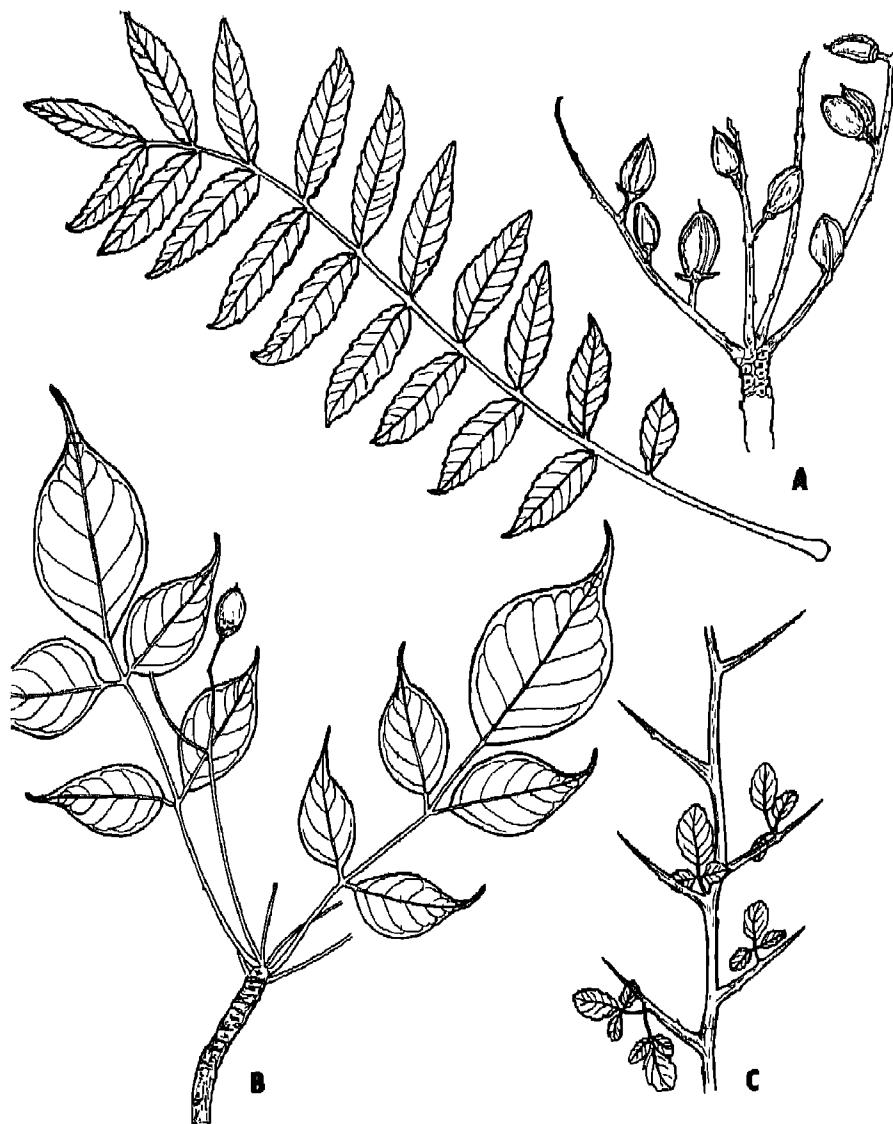


Fig. 4113 A. The Indian Olibanum
C. Mulkiluvai

B. Kiluvai

be easily propagated by cuttings. A thorny relative of it called Mulkiluvai (*Commiphora berryi*, Fig. 4.113C) is commonly used as a hedge plant all over South India.

THE DRUMSTICK or HORSE RADISH TREE (*Moringa oleifera*, Fig. 4.114) is commonly grown in every back garden, waste plot or village in South and East India. It is found wild along streams and rivers in the sub-Himalayan tracts. It is a small spreading deciduous tree with brittle branches and soft white wood. The leaves are thrice compound with smooth obovate leaflets. The creamy-white and honey-scented flowers appear in large, loose clusters. The long pod-like fruit is up to 50 centimetres long. It is green in colour, prominently grooved and contains a long row of three-winged seeds, along its length. Young fruit is a very popular ingredient of curries. The leaves and flowers are also eaten as vegetable. The gum exuding from the wood finds use in native medicine. From the seeds is obtained an oil similar to the Ben oil of watchmakers obtained from a related African species. It is used for fine machinery and in perfumery. The tree is often lopped for fodder and is much liked by domestic animals, especially camels. There are several varieties of the tree, some of which are considered best for their fruit.

BISHOPWOOD TREE (*Bischofia javanica*, Fig. 4.115) is widespread in our forests. The palmately compound leaves have three leaflets each. The flowers are minute and without petals. They are unisexual as is the rule in its family. Separate male and female trees are recognizable. The hard timber is used for construction purposes. Tigers seek these trees for cleaning their claws and where these animals abound, the bark of these trees is often seen deeply scored with their claw marks.



Fig. 4.114 The Drumstick tree

THE INDIAN HORSE-CHESTNUT (*Aesculus indica*) is commonly seen in the Himalayan hill stations. It has palmately compound leaves like those of the Red Silk Cotton family, but is however not related to them. The fruit is given to horses for colic and is also eaten roasted in times of scarcity. Its wood is put to various uses.

WALNUT TREE (*Juglans regia*, Fig. 4.116) occurs in temperate climates all along the Himalayas where it is widely cultivated in the Western parts as for instance in Kashmir and Himachal Pradesh. It is a large deciduous aromatic tree with a furrowed bark on old stems. Male and female flowers are borne on the same tree, the former in pendulous spikes on the previous year's wood and the latter solitary or 2 to 3 together. The fruit is a drupe with an outer fleshy covering that is removed so much so that the marketed dry fruit is left with only the hard shell that can be broken in two halves to reveal the single seed with the lobed cotyledons which recall the shape of the human brain. The best Walnuts are those of the *Kaghzi* variety.

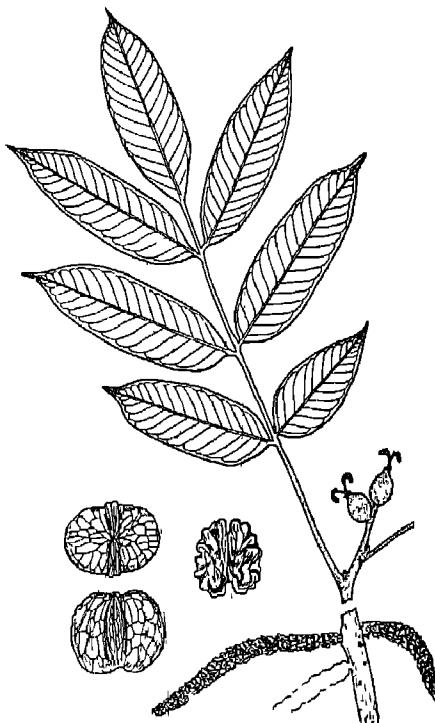


Fig. 4.116 Walnut tree

of Kashmir and have thin readily breakable shells. Fruit of the wild Walnut trees is useless but is of course eaten by squirrels, rats, birds, bears and monkeys. The Walnut timber, which is dark-greyish in colour, is beautifully mottled or figured. Being light, durable and capable of taking a fine polish, it is a highly prized timber for making furniture, cabinet work, carved fancy articles, gun stocks, etc. The tree sometimes bears burrs which are even more highly valued for veneers because of their exceptionally fine figure.

PARKIA (*Parkia roxburghii*, Fig. 4.117) occurs wild in Assam and is sometimes planted in gardens. It has feathery bipinnate compound leaves. The small flowers are massed together in innumerable numbers into dense heads, which hang down on very long stalks recalling drumsticks.

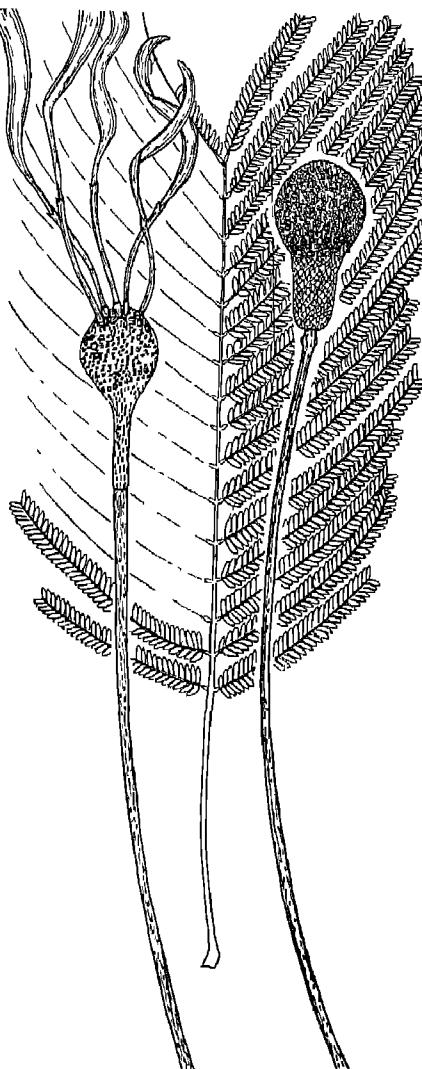


Fig. 4.117 Parkia

Native Conifers and Their Relatives

CONIFERS are typical forest trees of the temperate and colder regions of the world in the life of whose people they play a vital role. Wherever they occur they grow gregariously forming almost pure forests of great forestry and economic value. In a predominantly warm country like ours, good coniferous forests naturally occur only in the cooler upper elevations of the Himalayas. The conifers composing these forests are Pine (*Pinus*), Deodar (*Cedrus*), Spruce (*Picea*), Fir (*Abies*), Larch (*Larix*), Cypress (*Cupressus*), Yew (*Taxus*), Hemlock (*Tsuga*) and Juniper (*Juniperus*). Most of these trees cannot thrive in our plains where

the scorching summer heat can readily kill them. However, some exotic conifers like Araucaria and Arbor-vitae do stand up well to the heat of our plains and are frequently grown as ornamental garden plants. The only conifer that occurs wild in southern India is Podocarp (*Podocarpus*). More or less related to the conifers are the Cycads and the Ginkgo which all together form a group of cone-bearing trees known as the Gymnosperms. It is to this group that the giant Redwood trees of California referred to earlier in Chapter II, also belong.

As a rule, the conifers (Larch is a notable exception) are evergreen. They have narrow, needle- or scale-like leaves unlike their broad-leaved temperate tree companions such as Willow, Oak, Poplar, Elm, Maple, Birch and Beech which are deciduous trees that shed all of their foliage in autumn and spend the cold winters completely leafless. The conifers on the other hand manage to retain at least part of their foliage even during the severest part of the winter when their boughs may be draped and heavily weighed down by snow for several days at a stretch.

The conifers are generally noted for their conical crowns made up of a skeleton of symmetrical branches. It is this feature and not their 'flowers' that give them their high ornamental value. In fact the conifers bear no flowers in the real sense but instead produce equivalent reproductive structures known as cones. Most conifers are wind-pollinated and produce during the season an enormous quantity of light pollen which is released as clouds of yellow dust that is wafted away by the wind. Such wind-borne pollen inhaled in quantity causes hay fever in some people.

Wherever they occur, the conifers are of great economic use to man. They are a source of very valuable timber, resin and

sometimes of edible fruit. Besides, they make an intangible contribution in terms of relaxation, mental health and aesthetics as they indeed do in many of our Himalayan hill resorts. Let us then get acquainted with them.

Pines are perhaps the most familiar of the conifers forming extensive forests in many parts of the world. They are typical needle-leaved trees with rough, thick and fissured bark. The adult leaves occur in fascicles or spurs of two, three or five and the base of each fascicle is enclosed in a sheath. The seed-bearing cones are large and woody. They are made of a number of spirally arranged scales with two-winged seeds on each scale. The tips of the scales are enlarged and in unripe cones are closely compacted and hide the seeds. When the cones are fully mature the scales fall apart and the seeds escape. Open cones remain on the tree for some more time and then fall away. Both unopen and open cones form nice decorative articles. Wherever they are plentiful the cones can be burned like pine-wood in the fire place to give not only warmth but also fragrance because of the resin they contain.

Of the four native pines three occur in the Himalayas, the fourth in Assam. The three Himalayan pines are Chir, Kail and Chilgoza pines. Pine is a characteristic soft-wood. It is easy to work in the carpenter's shop and is used for making cheaper forms of doors and for panelling.

CHIR or THE HIMALAYAN LONG LEAF (*Pinus roxburghii*, Fig. 5.1A) is the most familiar and abundant of our native pines. It occurs at lower elevations on the outer ranges and in the principal valleys of the Himalayas and on the ridges of the adjoining Shiwalik hill ranges between 460 to 2,280 metres. Towards its upper elevation limit it mingles with the Deodar,

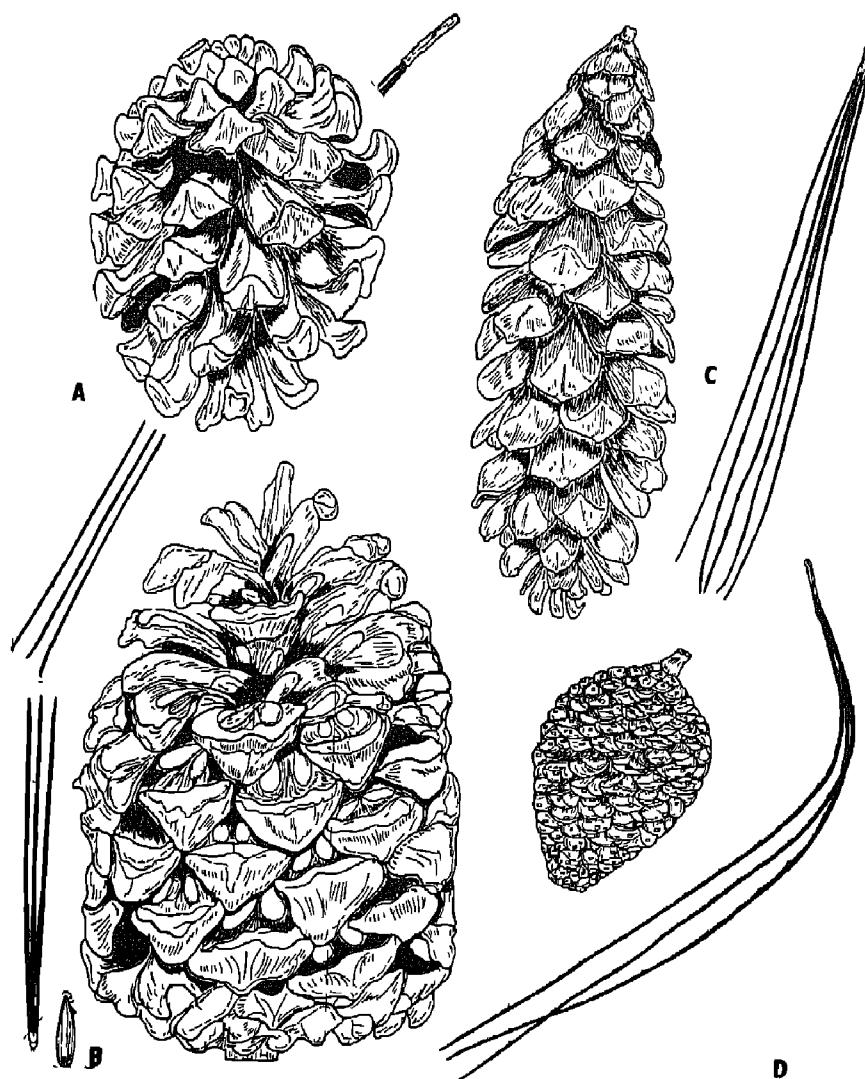


Fig. 5.1 Leaves and mature cones of native Himalayan Pines
A. Chir Pine; B. Chilgoza Pine; C. Kail Pine;
D. Khasi Pine

Kail and Rhododendrons whereas its lower limit associates are the Sal and other tropical species. The long needles occur in fascicles of three. The bark of young trees peel off in narrow plates, and that of older trees in broad plates. The bark of the older trees therefore develops a neat plated pattern. The peeled surface is at first red, turning grey on the surface with exposure. The male and female cones are placed separately on the same tree. The seed-bearing cones take more than two years to mature and open. Thus at any one time it is usual to see on the tree green unripe cones, brown woody cones and mature open cones that have shed their seeds but still remain attached for some more time to the tree.

On account of its ready accessibility and abundance, the Chir is one of the important timber trees whose relatively cheap wood is much used for general carpentry in northern India. The Chir is also our principal resin-yielding pine. Although the quality of the resin is slightly inferior to that of the Kail or the Khasi pines, the yield is greater and as this species grows in relatively more accessible places the trees can be systematically tapped. Large areas of the Chir forests have been destroyed in the past by cutting, lopping and burning for pastures and for terrace cultivation. Many of the existing grass-covered or barren slopes of the outer Himalayan ranges must have been covered at one time with forests of this pine. Hillfolk believe that the Chir is particularly prone to strikes by thunderbolts.

CHILGOZA PINE or THE HIMALAYAN EDIBLE PINE (*Pinus gerardiana*, Fig. 5.1B) like Kail occurs between 1,820 to 3,650 metres in the Western Himalayas, but it is confined to the drier inner valleys which are outside the reach of the monsoon and hence receive only scanty rainfall but plenty of

winter snowfall. It can thrive on excessively dry barren hill-sides with shallow soil and even on bare rocks. It occurs as isolated specimens or in scattered groups and at places may be associated with the Deodar or Kail. Like the Chir and Khasi pines, it is also a three-needle pine but it can be recognized from either of them by its thin smooth bark which peels off as large thin scales. In this latter respect it is somewhat exceptional among pines in general which are usually characterised by thick bark. The main use of this pine is its edible seeds, the Chilgoza, which is sold in dry fruit markets. The seed-bearing cones of this pine take only $1\frac{1}{2}$ years to ripen. The cones are picked when still green, heaped up and burnt in order to cause them to open, after which the seed is picked out and marked. It is eaten raw or more often roasted. Our supplies of this pine which occurs mostly in Himachal Pradesh and Punjab, are limited so much so that we have to import large quantities of Chilgoza from Afghanistan where this pine thrives most abundantly.

THE BLUE PINE or KAIL (*Pinus wallichiana*, Fig. 5.1C) occurs in the temperate Himalayas at altitudes between 1,820 to 3,800 metres. Its altitudinal range is greater than that of any other Himalayan conifer. Whereas at its lower elevation limit it mingles with the Chir pine, at its higher limits it is at home with the Birch and Juniper although stunted in growth at great heights. It is most abundant between 1,820 to 2,590 metres. The Kail can easily be recognized because it is the only Pine in the Himalayas whose needles are in fascicles of five and have a bluish-green hue on account of which it is called the Blue Pine. Abnormal leaf fascicles with four, six or even seven needles may also occur. The seed-bearing cones are longer and narrower than those

of the Chir. When young and growing vigorously this is one of the most beautiful pines of the world, its long bluish drooping needles and regular growth making it particularly graceful to look at. The Kail occurs both as pure stands as also mixed with other conifers like the Deodar, Spruce and Fir and broad-leaved species like the Oaks. Among the conifers its most important companion is the Deodar and mixed stands of the two are frequently met with. Wherever the Kail occurs, snow falls during the winter and yet it suffers chiefly from snow damage more than any other Himalayan conifer. The timber and resin of the Kail are superior to that of the Chir and are put to the same uses. But since it occurs only at higher elevations, supplies of it are not abundant and although its resin is superior it is not systematically exploited.

KHASI PINE (*Pinus kesiya*, Fig. 5.1D) is the common native pine of Assam and adjoining areas where it is as plentiful at lower elevation from 900 to 2,130 metres as the Chir is in the West Himalayan ranges. Like it, it is also a three-needle pine. The bark is reddish-grey, and deeply fissured. The wood is moderately hard, pale-red, very resinous and hence burns well. It is much used in the Khasi hills for building and as torchwood. Its resin which like that of the Kail is slightly superior to that of the Chir has not yet been commercially exploited. The Khasi pine areas often suffer from the practice of shifting cultivation by the tribals.

DEODAR or THE HIMALAYAN CEDAR (*Cedrus deodara*, Fig. 5.2) known in Sanskrit as *Devdaru*, meaning the tree of the gods, is one of our stateliest trees. It forms pure and fine forests most commonly at the height of between 1,800 to 3,300 metres in the Western Himalayas. It is also found mixed with other conifers and broad-leaved species. It can be distinguished

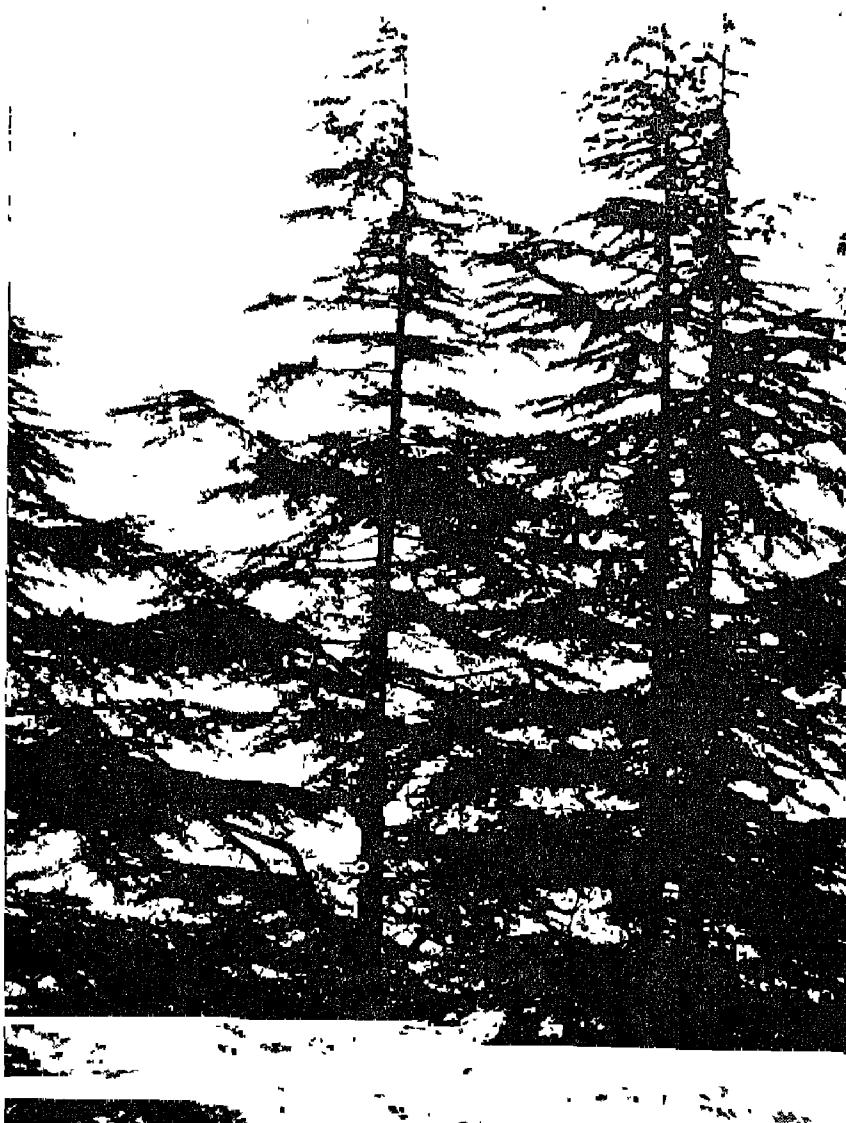


Fig 5.2 Deodar trees at Mussoorie

from other conifers by its branches arising irregularly on the stem, not in symmetrical circles. The foliage has dark-green or silver-blue hue and in young trees the ends of the leader shoot and branches are drooping. The leaves are stiff, triangular and needle-like. On long shoots they are alternate but on dwarf shoots they are clustered. Unlike as in pines, male and female cones usually occur on different trees. The seed-bearing cones are ovoid, smaller than in pines with much compressed scales which are also shed along with the winged seeds, leaving behind only the cone axis on the tree and this pointed structure persists for a long time.

The Deodar can live up to a great age and trees as old as 750-900 years are recorded. Some fine and very old specimens are found in temple groves where they are well protected from injury and destruction. They attain large dimensions and may be as tall as 61 metres or more.

The Deodar is the strongest of the Indian coniferous woods. Its timber is strongly scented and is very durable. It is in great demand and is much used for railway sleepers, buildings, general carpentry, furniture and for other purposes wherever durability counts most.

The Spruces are represented by two distinct species, one in the Western Himalayas and the other in the Eastern. The former has needle-like leaves that are squarish in section whereas in the latter the leaves are flattened. In both, the cones are pendulous and ripen in one season. The cone scales persist as in pines even after the two-winged seeds have escaped.

WEST HIMALAYAN SPRUCE (*Picea smithiana*, Fig. 5.3A) is common throughout the Western Himalayas at elevations

between 2,130 to 3,350 metres but it occurs commonly mixed with the Silver fir or the Deodar, Kail, Oak or other broad-leaved temperate species. The Spruce stands less heat and needs more moisture than the Deodar. The trees are often festooned by a vine, the Himalayan Virgin creeper, which turns bright red in the

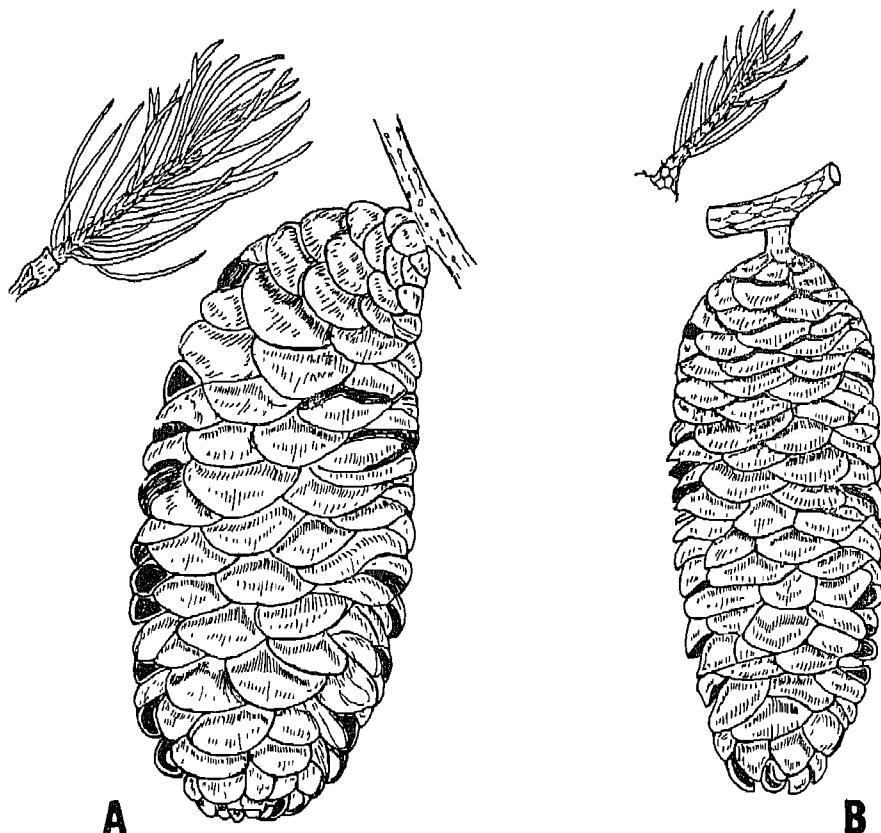


Fig. 5.3 A. West Himalayan Spruce
B. East Himalayan Spruce

autumn. The attack by insects usually leads to the development of false cones which should not be mistaken for the red cones containing the reproductive structures. The bulk of the spruce timber goes to the railways as treated sleepers. The rest is used for planking in ceilings and floors, general joinery, cheap furniture, shingles, boxes, crates, etc. During World War II the wood was found to be a good substitute for making aircrafts and gliders like the Sitka spruce of western countries. It is a potential but as yet untapped source of paper pulp.

EAST HIMALAYAN or SIKKIM SPRUCE (*Picea spinulosa*, Fig. 5.3B) is one of the tallest of the Spruces. The branches are pendulous as in the West Himalayan Spruce but the leaves are flattened, not squarish as in that species. The bark peels off in quadrangular plates. The wood is similar to that of the West Himalayan Spruce.

The Firs are tall trees with a pyramidal crown when young. Branches are more or less symmetrically arranged in circles. The leaves, which may or may not be flattened, always have a pair of white or greyish lines, one on the either side of the midrib on the ventral surface. It is on account of this that these trees are also commonly referred to as the Silver Firs. When the leaves fall there is left behind a disk-like leaf scar and this distinguishes the firs from all other conifers. The erect seed-bearing cones break up as soon as the seeds are ripe and only the erect spindle-like axis is left behind on the tree.

PINDROW FIR or THE LOW LEVEL HIMALAYAN FIR (*Abies pindrow*, Fig. 5.4A) occurs throughout the Western Himalayas chiefly at the height of between 2,200 to 3,300 metres, commonly mixed with the Spruce, sometimes with the Deodar,

the Kail and broad-leaved species. It is a lofty tree with a narrow cylindric crown of very dark foliage. The tree lends a touch of grandeur to the forests in which it occurs. There is a heavy snowfall in the Pindrow Fir areas and the depressions down the mountain slopes here lie for several months under deep snow. But the Fir avoids these depressions. The

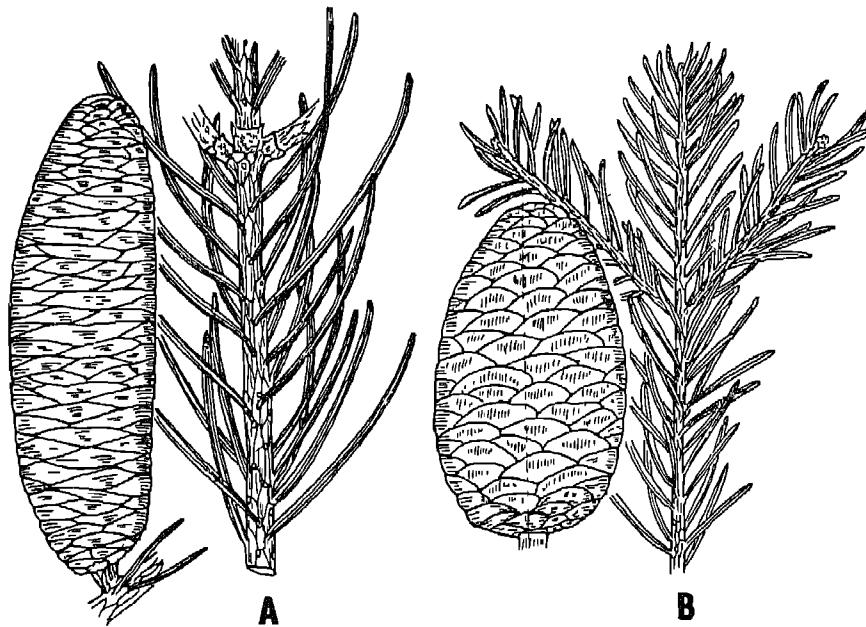


Fig 5.4 A. Pindrow Fir
B High Level Himalayan Fir

wood is a useful light wood, suitable for making packing cases, shingles, containers, fruit crates or matches. It is put to several other uses like the spruce wood and is a potentially valuable source of paper pulp. Supplies are adequate for this purpose.

HIGH LEVEL HIMALAYAN FIR (*Abies spectabilis*, Fig. 5.4 B) occurs generally at higher elevations (between 2,300 to 3,900 metres) than the Pindrow Fir in the Western Himalayas. It is more abundant and often forms large areas of forests. It has shorter and thicker leaves than the Pindrow Fir and these are white beneath. Its wood is put to the same uses as that of the previous Fir.

EAST HIMALAYAN FIRS (*Abies densa* and *A. delavayi*) form forests of considerable extent above 3,200 metres in the Eastern Himalayas. At higher elevations they become stunted and are often associated with the Juniper.

The Larches are unusual among the conifers in that they are deciduous unlike most of the others. Otherwise they recall the Cedars rather closely in branch and leaf arrangement. The cones, however, do not break up as in the Cedars but hang on the branches for a long time after the seeds are shed.

HIMALAYAN or THE SIK-KIM LARCH (*Larix griffithiana*, Fig. 5.5) is the only native Larch. It is common at the height of between 2,400 to 3,650 metres in the Eastern Himalayas but interestingly enough does not occur at all in the Western part.

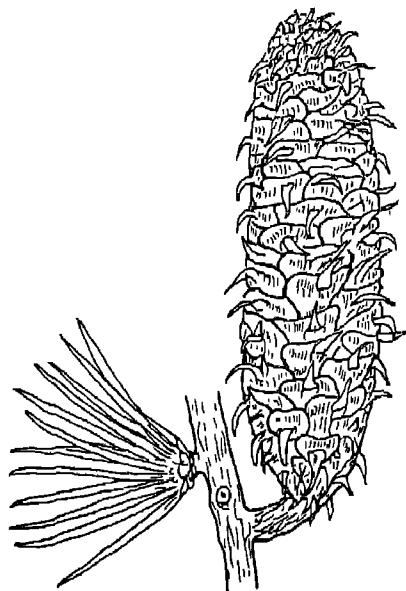


Fig. 55 Himalayan Larch

Like the Larches in general it is a deciduous conifer. The needles are completely shed during the autumn and new foliage appears in the spring as in the Oaks, and other broad-leaved temperate trees. The bark is thick and brown. The cones ripen in the same year. This species is not of any great importance as a timber tree.

COMMON YEW (*Taxus baccata*) is an evergreen shrub or tree, sometimes attaining large dimensions in the Himalayas where it occurs chiefly above the elevation 2,133 metres and often as underwood to broad-leaved species and other conifers. The needles occur in two neat rows. They are dark-green and shining above and light-green below. The bark is thin, reddish-brown and scaly. The wood is tough and elastic. It is well suited for making bows for archery and was perhaps used for this purpose by our ancients. The needles sometimes contain a poison. The Yew grows very slowly and can live up to a great age.

The Junipers are evergreen shrubs or trees of wide distribution. The leaves on young plants are needle-like. Adult leaves are either needle-like or scale-like. The cones are succulent and berry-like. Four kinds of Junipers occur in the high, dry and barren regions of the Himalayas where rainfall is scanty. In fact the Junipers are among the few woody species extending well beyond the tree line into the Alpine heights of 4,570 metres or more.

COMMON JUNIPER (*Juniperus communis*, Fig. 5.6A) is a widespread plant. It is abundant in Europe where its fruit is used in the manufacture of gin. In the Himalayas however it is confined to the higher elevations where it keeps company with

the Black Juniper (*Juniperus wallichiana*) and the Drooping Juniper (*Juniperus recurva*). Surprisingly enough, the last mentioned Juniper can be cultivated at very low elevations and even in the plains.



Fig. 5.6 A. Common Juniper
B. Himalayan Pencil Cedar

HIMALAYAN PENCIL CEDAR (*Juniperus macropoda*, Fig. 5.6B) is actually not a Cedar but a Juniper. It bears both needle leaves and scale leaves. Its wood like that of some exotic species furnishes good quality pencil cedar-wood but supplies of it are inadequate to support a major pencil-wood industry. It is however used locally for buildings, utensils, fuel and charcoal at high elevations where other tree species are scarce.

CYPRESSES (like Arbor-vitae) belong to that kind of conifers whose adult leaves are not needle-like but scale-like and are closely appressed to the twigs on which they spring. Only the

primordial leaves of the seedlings are needle-like but these soon yield place to the adult scale leaf form. The male cones are cylindrical and occur at the ends of the branchlets. The female cones are rounded. The seeds are small and winged.

HIMALAYAN CYPRESS (*Cupressus torulosa*, Fig. 5.7) is

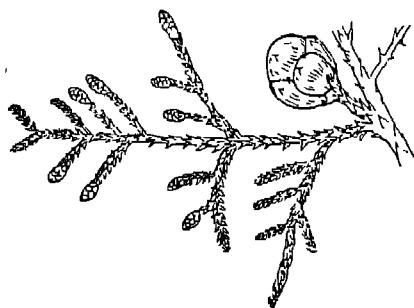


Fig. 5.7 Himalayan Cypress

for buildings, often in temples and also as incense. Other more familiar but introduced Cypresses as well as the Cypress-like Arbor-vitae commonly seen in gardens are dealt with in Chapter 7.

The Hemlocks are evergreen trees with horizontal branches. The branchlets are often pendulous at the tips. The leaves usually arise in two ranks. They are flattened with two whitish lines below. Male catkins are rounded whereas the female cones are oval in outline. Both arise on the same tree and the seed-bearing cones mature in one season.

HIMALAYAN HEMLOCK (*Tsuga dumosa*) is the only Hemlock of our country. It occurs in the central and eastern parts of the Himalayas often in association with the Rhododendron, the Spruce and the Fir. It is readily distinguishable from other

conifers by its small globular cones. It is a tall pyramidal tree with gracefully drooping branches. The bark is thick and rough. In Sikkim its timber is made into shingles and the rough bark is employed for roofing. The poisonous Hemlock that the Greek philosopher Socrates was forced to take is not a Gymnosperm but a small flowering plant belonging to the Coriander family.

The Podocarp is the only conifer that occurs naturally in South India. Of the two wild species in our country, one (*Podocarpus wallichianus*, Fig. 5.8.A) occurs in the Western Ghats in Malabar as well as in Assam. The other (*Podocarpus nerifolius*, Fig. 5.8B) occurs at low elevations up to 900 metres in

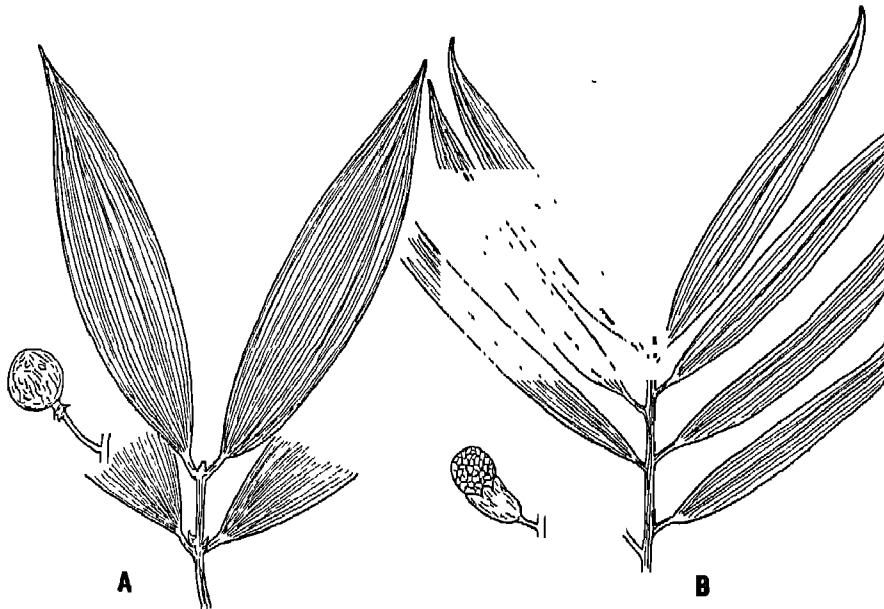


Fig. 5.8 Podocarps

- A. Southern Podocarp
- B. Eastern Podocarp

the Eastern Himalayas, Assam, Khasi hills and the Andamans. The Podocarps are tropical evergreen conifers that are not very tolerant of cold. They bear stiff, lanceolate and leathery leaves. The bark is thin. The yellowish wood is used in general carpentry. Male and female cones are usually borne on separate trees.

CEPHALOTAXUS (*Cephalotaxus* species) has two species in the Eastern Himalayas, Assam and Arunachal Pradesh. They are yew-like trees.

Besides the several native conifers described in the foregoing pages, some conifer natives of other lands have been introduced successfully in our country and are grown either in plantations or as ornamentals. Some of these the reader will find described in Chapter 7.

Mention may now be made of some other Gymnosperm trees of interest that are more or less distantly related to the conifers, but are not conifers in the real sense.

The Cycads are mainly tropical trees of the East which can readily be mistaken for palms. In reality, however, they are close to a long lost group of primitive seed plants that arose from the ferns. Today nowhere do the Cycads form extensive forests such as those of the true conifers.

Cycads are small trees typically with unbranched trunk bearing a crown of feather-like compound leaves. The trunks are covered with ring-like marks and the bases of fallen leaves. They are mostly fleshy, fibrous and starchy, not woody. The male and female trees are distinct. The cones are very large and are borne at the apex of the trunk, first concealed by the bases of the leaves. The female cones emit a strong oppressive

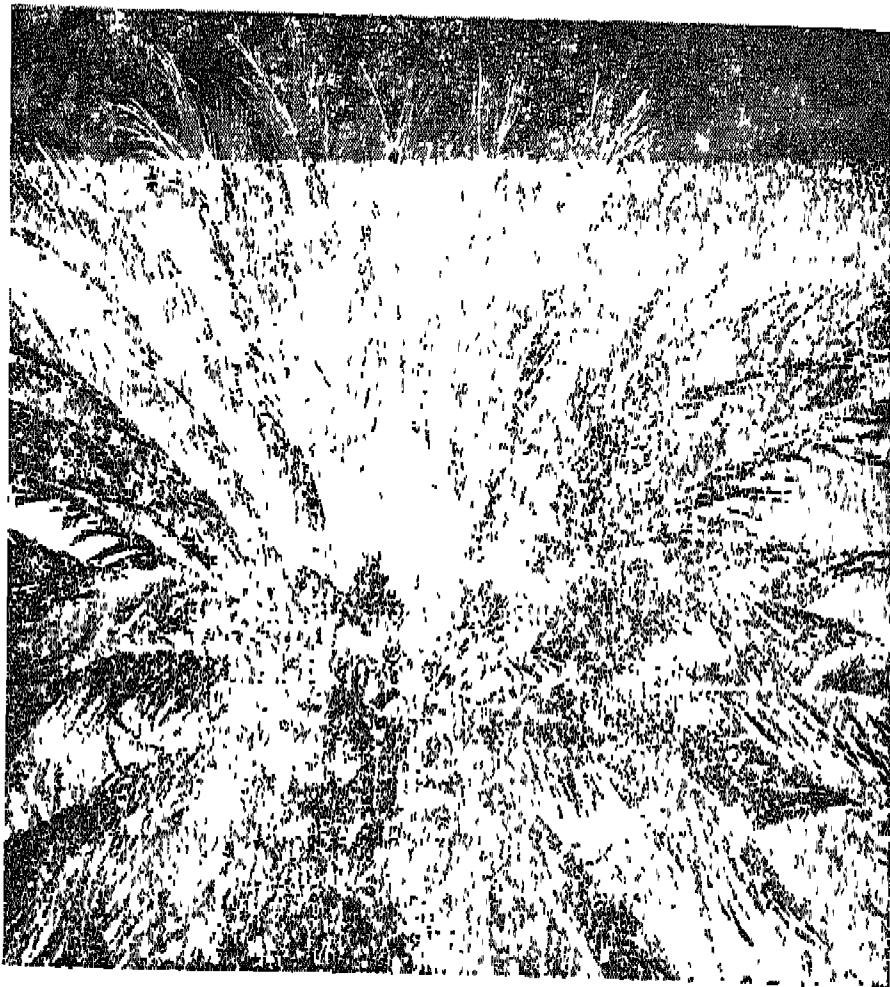


Fig. 5.9 Sago Cycad, a female tree bearing cone

smell when ripe and unlike the true conifers the Cycads are insect pollinated.

The Cycads are among the most ornamental plants of tropical and subtropical gardens. Their beautiful, glossy, feather-like leaves are used in India and in many other countries for ornamenting temples and for decorating altars. The starchy stems of some species are eaten cooked in tropical countries. The ripe seeds are also edible.

Although four kinds of Cycads occur wild in the Indian region, the one that is most familiar and commonly cultivated as an ornamental in our gardens and in many other parts of the world is a native of China and Japan. It is known as the Sago Cycad (*Cycas revoluta*, Fig. 5.9) and usually only the female plants are met with in Indian gardens. Its compound leaves after silvering and various other treatments are made into funeral wreaths in Europe.

MADRAS CYCAS (*Cycas beddomei*) and Crozier Cycad (*Cycas circinalis*) both occur wild in South India, the former on open dry hills, and the latter which is relatively more abundant occurs in the deciduous forests and its leaves are used for making mats. The young shoots are edible and Sago is obtained from the stem. The seeds are said to be poisonous in the uncooked state.

NEPAL CYCAS (*Cycas pectinata*) is found in Sikkim, Nepal, Bihar and Assam. The hill tribes of Assam eat its seeds and tender fleshy shoots. The starchy stem is pounded and used as shampoo for the hair.

Lastly, a few words about some flowering trees which recall rather closely the conifers but are of course not related to them.

The Casuarina is a notable example of such trees. It is so deceptively like a conifer not only in its needle-like branchlets bearing scale leaves but also in its male flower clusters and the hard, woody aggregate fruit which looks so much like a round cone. The Tamarisks somewhat recall the Cypresses in their small, appressed scale leaves.

Palms, Bamboos, and Bananas

PALMS are, as a rule, found in the tropics where they form one of the most distinctive and useful groups of trees. There are some 100 different kinds of them in our country. While most of them are found in forests, there are some like the Coconut-palm, Palmyra-palm, Wild Date-palm and Areca or Betelnut-palm which have been commonly cultivated since time immemorial for their useful products. They lend beauty and character to the landscape in many inhabited parts of the Indian countryside. Many palms are also planted in gardens for ornament.

Palms form an exclusive group by themselves. They can readily be recognized by their unbranched trunks which bear at their extremity a crown of large feather-like or fan-like leaves. Some have smooth stems while in others the stems are roughened by the scars of the fallen leaves. In the Date-palm the stem is densely beset with the ragged bases of the fallen leaves. Palm leaves are large and their blades are neatly plaited or folded up in buds. The older leaves do not fall off abruptly as in other trees but gradually decay and persist for a long time on the tree. Ultimately they fall off by their own weight or get broken off by wind or rainstorm. In many fan-plams the living foliage appears to rest on a thatch of dead leaves. The primary root of palms soon perishes and is replaced by a number of fibrous roots springing from the bases of the stem.

Unlike most other trees, palms do not add a fresh zone of woody growth every year. That is why the mature stems of any one kind of palm is more or less of a standard thickness determined early in the life of the individual. Thereafter, there is no appreciable radial growth although the growth in height may continue for a long time.

The individual flowers of palms are small, and pale-coloured but they are rendered very conspicuous because several hundreds of them occur massed together. Before the flowers open, a sweet sugary sap in considerable quantities flows into the flower-bearing axes out of which from early times the local inhabitants have made palm jaggery, palm sugar or upon fermentation obtained the intoxicant drinks known as toddy and arrack. While most palms keep flowering every season for scores of years, some like the Talipot- and Sago-palm die after producing

only one gigantic flush of flowers. In this respect they recall the Bamboo and the Banana. The Coconut, Betel-nut and most other palms produce both male and female flowers on the same tree. In the Palmyra and Date-palms, however, separate male and female trees are recognizable. In fact it is the Date-palm that seems to have given the first inkling of the existence of sex in plants to ancient Egyptians, Babylonians and Hebrews, although the scientific discovery of sex in plants came much later in medieval Europe. These ancient people knew that when pollen from certain Date-trees were transferred on to certain others, a much larger harvest of Date fruit could be obtained. In nature wind and insects effect such transfer.

Compared with the size of the plant the fruits of Palms are generally small like the fleshy Date or the fibrous Betel-nut. Coconut is one of the larger fruits and in fact that of the Double Coconut is one of the largest in the plant kingdom. The last two are both fibrous with a hard shell within. Many palm fruits contain but one seed whose inside may be very hard like the stone within the Date. In Betel-nut it is not so hard and is good to chew. In the Coconut the kernel inside the hard shell is soft, white and very palatable; when tender it contains a liquid called the Coconut milk.

COCONUT-PALM (*Cocos nucifera*) is one of the most useful of palms. It flourishes in the greatest luxuriance in the vicinity of tropical seas wherever the soil is sandy and saline. The Coconut-palm-fringed coasts and backwaters are an all too familiar sight in our southernmost state Kerala in the daily activities of whose people it plays a vital role. This palm is also cultivated inland and far from the coast where the soil is

not necessarily saline. But in such areas it is customary to add to the soil in which it is planted, a sizable quantity of common salt. The average northerner would not have ordinarily seen this palm although he would have occasionally eaten the fresh Coconut imported from the South and sold at an expensive rate in the northern market. The reason is that the Coconut-palm, like many of its relatives, is very sensitive to frost and cannot thrive and yield fruit in the North where the severe winters and dry hot summers would readily kill it. Like palms in general, the Coconut tree has but one trunk with its single growing point and if this is damaged or killed that will mean the end of the entire tree.

Plant geographers believe that the Coconut-palm was originally a native of the Cocos islands in the Pacific ocean. From there this palm spread far and wide along the entire tropical coastline by ocean currents, its fruit being one of the best suited for natural dispersal by sea-water. Man further aided its spread. Known in Sanskrit as *Nari-kela*, the Coconut must have been under cultivation in our country since very ancient times.

From a swollen inclined base surrounded by a mass of rootlets the trunk of this palm rises 12-24 metres high. The ring-like marks of the leaf scars are faint. The stem is straight or frequently curved, lending a touch of artistry to the palm. On sea coasts with strong one-sided winds the stem may even lean to one side. The large compound feather-like leaves are from 3.5—5.5. metres in length with a stout thick stalk. The leathery, sword-shaped leaflets each measuring 60-90 centimetres in length are arranged flat like the bristles in a feather. The male and female flowers develop on the same tree. The males are smaller

and usually arranged towards the top of the many-branched inflorescence which is at first enclosed in a sheath. The familiar fruit is of the size of a man's head. It is ovoid, smooth, three-sided and greenish-yellow, turning brown with age. It has a thick fibrous husk surrounding a hard shell within, which contains the white edible kernel of a single seed. The coconut sold in the market however has part of the husk removed but for a handy tuft of fibre at that end of the shell where the three 'eyes' are situated. This represents the basal end of the fruit. When the seed within the coconut begins to germinate the young root and stem press and emerge through the 'eyes' while within the shell a spongy apple is formed which absorbs the kernel till it is exhausted. This 'apple' is nice to eat. The palm flowers and fruits throughout the year and the nuts require 9-10 months to come to maturity. The Coconut-palms take several years to come to flower and bear fruit but once they do they continue to bear for scores of years thereby amply rewarding the patient planter. The Andaman dwarf variety does not attain much height and comes to bearing earlier than the tall native ones which however live much longer. It is a delightful sight to watch the coconut pluckers nimbly and rapidly scale the tallest trees to harvest the nuts. This they do with only a noose of coir rope to hold their feet together around the branchless trunk.

There is scarcely any part of the Coconut-palm that does not find one use or the other by the local inhabitants. The liquid inside tender coconuts and known as the coconut water or coconut milk is a delicious cooling beverage. Although the palm itself is one that thrives in the saline soil, the milk is surprisingly sweet and pleasant to taste. The white kernel known as

the coconut meat when tender can be easily scooped out of the unhardened shell and is equally delicious. As the fruit ripens this kernel grows thicker and firmer. Meat from ripe coconuts, fresh or dried as copra, is an important commercial article used for various culinary purposes, especially in the South where it is customary to offer coconuts for worship and to guests during weddings and on other social and religious occasions along with betel leaves and betel-nuts. From copra is extracted the commercial coconut oil. It is the all-purpose oil of Kerala where it is also the chief cooking oil. Its chief use elsewhere is as hair oil for which purpose it is often perfumed. The coconut oil readily turns rancid and it is then unfit for cooking. It solidifies in cold weather. Poonac, the refuse after the oil has been extracted from copra is the best manure for young coconut trees because it replenishes in the soil the very nutrients that the palm extracts through its roots. It can also be fed to cattle and poultry. Coir is the fibre of the coconut husk. It is a very useful article. Out of it are woven coir ropes and coir matting. It is also used for stuffing mattresses, sofas and saddle and for making rough coir brushes. Large quantities of coir fibre are regularly shipped to Europe where it earns for our country valuable foreign exchange. The fibre is resistant to salt water and hence ropes made of it are much used for tying rafts and boats and in making fishing nets. Palm jaggery, palm sugar and toddy are obtained from the Coconut-palm in much the same way as from other palms. The soft downy fibre forming a natural mat at the bases of the leaves is used for straining crude coconut oil and the toddy after extraction. In villages dry leaves of the palm are much used for thatch and the trunk as



Fig. 6.1 Palmyra-palms on a hillside near Coimbatore

beams and rafters for huts. From the leaf ribs are made the coconut brooms commonly sold in the market. Split halves of the stem are used as water conduits in villages. From the outer wood of the trunk which is known as Porcupine wood, as also from the hard shell of the nut, fancy articles can be made. The latter serve as handy vessels or containers in the house.

PALMYRA-PALM (*Borassus flabellifer*, Fig. 6.1) is a native palm that is widely cultivated in the plains. It is especially abundant on the Coromandel coast. If the Coconut is a typical feather-palm the Palmyra is typical of a fan-palm with spreading ribbed leaves looking like giant hand fans. They are of an ashy-green colour when fresh. The trunk reaches 30 metres high or more. It is black, swollen above the middle and begins tapering upwards. Only when it is young is it covered with dry leaves or the jagged bases of the petioles. The older stems are relatively smooth with black narrow scars of the fallen leaves. Near the ground a dense mass of long rootlets enclose the stem. The male and female flowers are borne by different trees.

The Palmyra has been described by Tamil poets as *Kalpavriksh* which truly it seems from the incredible number of uses it is put to wherever it occurs. The famous Tamil poem "Tala Vilasam" enumerates no fewer than 801 different purposes for which parts of this palm are used. This is because every part of the tree is used one way or the other as much as those of the Coconut-palm. The most important is as a source of food. Toddy, "almost as famous for its use and notorious for its abuse" is the fermented juice drawn from the bruised flower-bearing stalks during the proper season. Toddy tapping as it is called is done by professional tappers expert at their job but

too often drunken and degraded. Like Coconut pluckers, they nimbly climb the tallest trees using as aid only a noose of a rope to hold their feet together. The sweet toddy called *Nira* and in Tamil *Carupaneer* is a refreshing drink. It is kept from fermenting immediately by sprinkling the inside of the clay pots used to secure toddy, with lime. The male trees yield more of the sap which is sweeter than that from the female. Palm jaggery, palm sugar and sugar candy are made out of the sweet toddy. The unspent toddy is converted into vinegar. Nungoo is the edible kernel of tender fruits and is refreshing to eat during the hot summer. The old tree trunks have outer wood that is harder and more durable than that of the Coconut-palm. Hence they are much used as rafters and pillars for huts and country homes. The leaves of the Palmyra formed the chief writing material in olden days before the advent of paper. Some of our old manuscripts are written thus. Known as *Olai* they were written upon by an iron pen. Even today they are sometimes used for this purpose when young children are ceremoniously initiated into the alphabets.

ARECA-NUT or BETEL-NUT-PALM (*Areca catechu*) has been under cultivation since so long that it is now seldom seen wild. Its seed is the well-known Betel-nut or *Supari* which together with betel leaf has been traditionally chewed as *Pan-supari* or *Vettalai-paku* in our country. It is an essential article for ceremonial and social occasions and in the South the Coconut also often features with it. Incidentally, the betel-leaf (*Pan* or *Vettalai*) does not belong to a tree, much less to a palm. It is the leaf of a slender vine related to the Pepper vine and like it is grown trained on suitable supporting trees which frequently

happen to be the Areca-palms themselves. The Areca-palms are mostly grown in the moist regions of Bengal, Assam and South India but because we chew more than we grow, considerable quantities of the nut have to be imported from Sri Lanka and Malaysia.

The Areca is perhaps the most graceful and elegant of our palms. It has erect and slender stems straight and ringed like that of a bamboo and attaining heights of 12-30 metres. The stem is green when young turning dark-grey as it grows old and is prominently marked with circles formed of the leaf scars. It bears a small crown of dark-green feather-like foliage. When in fruit, the tree looks even more beautiful with its long bunches of orange-red oval berries standing in good contrast to the dark-green background of the foliage. Unlike the Coconut this palm bears fruit but once a year. It comes to bearing in 6-12 years but may take 30 years to give full production. The total life of the tree is 60-100 years. Since the Areca-palms are often planted close together the betel-nut pluckers after harvesting one tree find it convenient to sway the slender pliable stem and with the agility of a monkey catch hold and clamber over the neighbouring tree. This way they save considerable time and labour climbing down and climbing up again, although at a considerable risk to their lives.

The seed is the most useful part of the palm. The untreated nut is greyish-brown in colour with deep reddish-brown

The raw nut suitably broken or sliced is used in the as such but in the South the nut is cured before use to improve its colour and taste. Curing consists of boiling the whole nuts or the seed in a mixture of water and previous year's

extract known as *Chogaru*. Sometimes the nut is reboiled with milk and honey to meet fastidious tastes.

The stems, leaves and leaf sheath of the palm are put to a number of odd uses in rural parts. The trunk is much used for building huts, for spearheads, splints, etc. The fibrous sheaths of the flower clusters called *Paak muttay* is used to make vessels, cups, dishes and small umbrellas. It can also be written upon with ink.

In wetter parts of Mysore two fungus diseases of this palm locally called *Kole roga* and *Anabe roga* cause considerable losses to yield of the nuts.

WILD DATE-PALM (*Phoenix sylvestris*, Fig. 6.2) is one of our commonest wild native palms. It occurs throughout the plains where it is often cultivated for tapping toddy and extends even up to 1,500 metres in the mountains. In some districts it forms gregarious forest growths over considerable areas and these are leased out by the government to contractors for tapping toddy and thereby yield considerable revenue to the state where there is no prohibition of liquor. In general appearance it recalls the true Date-palm to which it is closely related. The leaves are stiff, feather-like and spinous. The greyish-green leaflets arise in two planes giving a spiky effect to the entire leaf. The hard persisting leaf bases form as it were a shaggy protective armour for the stem. As already described at length under the Banyan tree, the angles between these bases form an excellent foothold for the Banyan and other wild figs that start their lives on other plants instead of in the ground.

The Wild Date-palm is the chief local source of toddy in parts of our country. Palm sugar is also made of its juice which is



Fig. 6.2 A trio of Wild Date-palms

tapped in a somewhat different way than that from the Palmyra and other palms. Its fruit is much smaller than that of the true date and very astringent to taste. Jellies and jams can be made of this fruit. In some places it is chewed like Areca-nut with betel-leaf and slaked lime. Other parts of the tree have their uses. Mats are woven out of the leaves and baskets made of the leaf stalks. Coarse ropes can also be twisted out of the latter and used for drawing water from wells.

DATE-PALM (*Phænix dactylifera*) is a typical desert palm of Arabia and Persia. Its mention immediately recalls to one's mind a picture of oases lined with these graceful denizens of the desert. The true date-palm does not occur wild in our country but is cultivated only to a limited extent in dry north-western parts of India, in Gujarat and South India. Much of the fruit is imported from the middle eastern countries.

The palm resembles our common wild Date-palm but is more robust attaining a height of 30-36 metres. The leaves are also much larger and the stem is closely beset with their jagged bases. Nomadic tribes of Arabia and their camels subsist almost entirely on the Date-palm for food and other needs.

FISH-TAIL, KITTUL or THE INDIAN SAGO-PALM (*Caryota urens*, Fig. 6.3) is found wild in most forest regions of our country and is also frequently cultivated in our gardens for ornament. The leaves of this tree unlike those of most other palms do not form a compact terminal crown but spring successively over a good length of the trunk. They are highly divided and their ultimate divisions are shaped like the tail of a fish which gives the palm one of its common names. The flowers and fruit arise in very long pendulous bunches,

The palm finds several uses. The fibre found outside and within the leaf sheath, flowering sheath and stem constitute the Kittul or Salopa fibre. Ropes made of this fibre are so strong that they are used to tether elephants and for tying ocean-going steamers. It is also used for making various kinds of brushes, baskets, caps and for stuffing purposes. Juice from the bruised flower stalks is the source of palm jaggery, toddy and *arrack*. The inside of the stem is starchy and from it is obtained Kittul flour or Sago which finds the same uses as the true Sago obtained from the Sago-palm. The nuts are used to make beads and buttons. The terminal bud of the palm known as the 'Cabbage' is eaten raw, cooked or pickled like those of many other palms. The carbonised roots of this palm find special favour among silversmiths and goldsmiths. The timber is much used for agricultural purposes, water conduits, beams and rafters.

TALIPOT-PALM (*Caryota umbraculifera*) is the most majestic of the Indian palms but it is so confined in its distribution that one seldom comes across this palm except in gardens. The stem when young is beset with stout leaf bases which later fall off to reveal a clean whitish bole encircled with close set ring marks. The leaf is of an enormous size and can well make a good hand fan for a giant. When outspread a single leaf can cover some seven or eight men and keep them dry when it rains. In their native areas therefore they are much used for making umbrellas. The Talipot bears flowers and fruit but once in its lifetime and then dies. In its youth it devotes itself to producing only huge fan-shaped leaves. Later on, a trunk begins to form which grows straight as a mast. The grand white stem is

encircled with closely set ring marks showing where it has borne and shed its leaves from year to year. When it attains full maturity its leaves become somewhat smaller and a gigantic flower bud some 1 metre in height develops at its summit. In due course this bursts with a report and unfolds a lovely white blossom which expands into a majestic pyramid of thousands of cream-coloured flowers rising to a height of 6 metres above the leafy crown. At the same time the leaves begin to wither and cover in this state for some time the upper part of the stem. At length they completely fall away leaving behind only the fruiting pyramid.

NIPA-PALM or WATER COCONUT-PALM (*Nypa fruticans*) is a small estuarine palm that forms dense masses in the Sundarbans of Bengal, the vast delta of the Ganga river. It also occurs in the Andaman and Nicobar islands. It has feather-like leaves recalling the Coconut-palm but with a creeping underground stem.

The leaves of this palm known locally as *Golpatta* are used for thatch for which purpose they are more durable than the Coconut-leaf. The fruit kernels are edible and a fermented drink is made out of its sap like toddy from other palms. The leaf stalks are used as fishing floats and for floating logs in the river.

DOUBLE COCONUT or SEA COCONUT-PALM (*Lodoicea seychellarum*) was, for a long time, a mysterious tree whose existence was but a matter of conjecture. For nobody had seen this palm which grew only in the Seychelles, a remote tiny group of islands in the Indian Ocean discovered only in the 18th century. It is a tall fan-palm with a long life. The fruit which is one of the largest in the plant kingdom is much like

coconut but many times its size and the shell is deeply bilobed. A full grown specimen may measure 1 metre in circumference and weigh about 11 kg. For several centuries before the palm itself had been discovered in its secluded home, the hard bilobed shells of its fruit set adrift by ocean currents from their native island home, used to be rarely picked up floating in the Indian Ocean near the Maldives or washed ashore on the Malabar coast. These rare and weird objects whenever picked up were often forfeit to the local chieftain or king and fetched a high price. They were objects of legend and superstition and were generally believed to belong to a tree growing at the bottom of the sea! Marvellous medicinal virtues were attributed to them. Mendicants and Sadhus still believe that those who drink water out of the cups and bowls made of this shell will be immune against every poison and disease. A *Kamandal* made of the shell of this nut is therefore one of the few precious earthly possessions of Sadhus and beggars.

The palm is difficult to grow outside its native islands where its various parts are put to the same kind of uses as the ordinary Coconut. Not only cups and bowls but several other familiar articles can be made of its hard black shell which is much stronger and more durable than that of the Coconut. The kernel of the fruit is soft and palatable when young but becomes very hard on ripening.

ROYAL-PALM or BOTTLE-PALM (*Roystonea regia*, Fig. 6.4A,B) a native of tropical America is often grown in our gardens for ornament. It is an excellent regal looking avenue palm with a smooth greyish stem usually swollen above the middle and abruptly ending in a green cone of tightly enclosing



Fig. 6.4A A vista of Royal-palms at Jantar Mantar, New Delhi

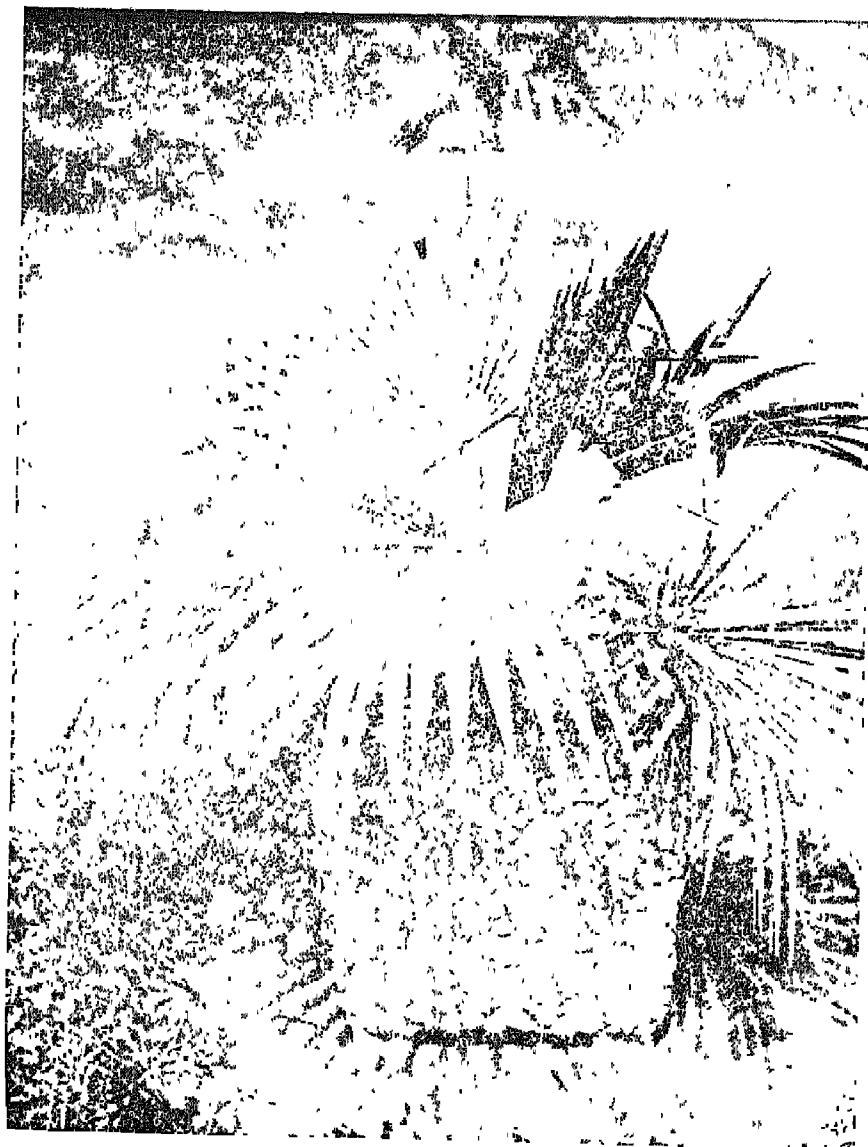


Fig. 6.5 Fountain-palm in a tub

leaf sheaths. The leaves are large and feather-like resembling those of the Coconut-palm. This palm is very decorative particularly when planted in avenues.

FOUNTAIN or FAN-PALM (*Livistona chinensis*, Fig. 6.5) is a common decorative palm usually grown in tubs in gardens. It is a native of Malaya and East Asia. Although in nature it can be as high as 15 metres, it lends itself admirably to be raised as a dwarf tub palm for decorative purposes either out of doors or even indoors. Before unfolding, the fan-shaped leaves are neatly folded like plaits along the prominent diverging ribs.

The Cane and Rattans (*Calamus* species) occurring in our forests also belong to the family of palms but they do not have the distinctive habit typical of other members of the family. The stem is not self-supporting. It is slender but strong and pliable like a cable or rope and well suited to seek support over the surrounding vegetation. It can attain a length of 90 metres or more. The leaves of the Canes are usually armed with hooked spines and bear whip-like prolongations both of which aid them to climb trees. Some thirty different kinds of Canes occur in our forests, mostly in those of Assam and the Western Ghats.

The stripped stems of these climbing palms constitute the natural cane of commerce which finds extensive use in making seats and backs of chairs and sofas. The unstripped thicker canes are used for furniture frames, walking- and polo-sticks and for umbrella handles. The stripped cane also finds use in wicker work and basketry. Wherever they occur naturally their stems are used as a good substitute for ropes and cable for building suspension bridges across torrential forest and mountain streams.

Bamboos, the Giant Grasses

It may be difficult to believe but bamboos, many of which grow to the size of a tree and sometimes as tall as 30 metres, are actually grasses like the sugarcane, wheat or rice. Unlike other trees, however, they possess no single trunk but instead a number of jointed branches called culms that issue periodically from an underground main stem usually to form a clump. As a rule, the culms are hollow and tubular with cross partitions at the joints. Many bamboos flower at long and infrequent intervals. Normally a bamboo clump flowers but once and then dies. Many bamboos show remarkably rapid growth of as much as 7.5 centimetres a day and in the Giant bamboo it can be as much as 35-40 centimetres a day. It is said that in ancient China one form of punishment inflicted was to tie the person to be punished to a fast-growing bamboo, which, as it grew, rubbed against the bare back of the hapless one, causing pain. The thickness of the culm varies from 2.5 centimetres in slender bamboos to 30 centimetres or more in very thick types. Almost all bamboos can be readily propagated vegetatively. In fact, in nature also, they usually propagate themselves by this method and only rarely by seeds.

Bamboos form one of the most useful groups of plants. They are used for building huts. Scaffolds, ladders, bridges, water conduits, brushes, pipes, fans, umbrellas, mats, chicks, baskets, toys, musical instruments, decorative articles, bows and arrows are also made of bamboo culms. Tender shoots are boiled to remove the poisonous compounds they contain and then used for curries and pickles. Tender leaves of bamboos form a

favourite food of elephants, deer and other wild life of our forests. Cattle and horses also relish it. Bamboo seeds are consumed as human food in times of scarcity and there is a belief that periods of bamboo flowering coincide with years of famine. In India, the most modern and industrial use of bamboo is in the manufacture of paper and synthetic fibres like Rayon. The normal bamboo pulp content of Indian paper is as high as 60 per cent. After treatment with preservatives, bamboo can even be used in place of steel rods for reinforcing concrete. Bamboo culms are normally coated with silica which render them hard. Sometimes a siliceous material accumulates in the culms. Known as *Tabasheer* or *Banslochan* this substance is a reputed tonic in oriental countries. Bamboo plays a vital role in the national economy of Japan, a nation where even houses are ordinarily built of bamboo and paper instead of brick and mortar. Several decorative bamboos find common use in that country.

There occur more than a hundred different kinds of bamboos in our forests chiefly in those of Assam, Bengal and South India. Two of our most widespread bamboos are the Male bamboo and the Thorny bamboo which occur as undergrowth in many of our forests sometimes forming impenetrable thickets.

MALE BAMBOO (*Dendrocalamus strictus*, Fig. 6.6A) derives its common name from the fact that its culms are unusually solid, not hollow as is usual in all bamboos. The name is, however, a misnomer because this bamboo, like all other bamboos, has bisexual flowers and there is no question therefore of separate male and female trees of them. It is the commonest bamboo of our deciduous forests and hence the most widely used.

THORNY BAMBOO, (*Bambusa arundinacea*, Fig. 6.6B) is really thorny as its common name implies. This, combined with its habit of forming impenetrable thickets makes the extraction of this bamboo a difficult proposition. It will therefore be very useful if spineless varieties of this bamboo could be evolved for plantation purposes.

GIANT BAMBOO (*Dendrocalamus giganteus*, Fig. 6.6C) is the tallest of bamboos, its culms attaining a height of 24-30 metres and a diameter of 20-25 centimetres. Like bamboos in general its culms are hollow with cross partitions at intervals. This bamboo is extensively cultivated for ornament. It is used for building purposes, for the masts of boats etc. Sections of its culms are used as buckets, flower pots and for various decorative purposes.

GOLDEN BAMBOO (*Bambusa vulgaris*, Fig. 6.6D) is the one often grown for ornament because of its beautiful yellow and green striped culms.

TULDA BAMBOO (*Bambusa tulda*) is a native of Assam and is also frequently cultivated in Bengal. Its culms are strong and hence it is a very useful species for building purposes.

Bananas, the Woodless Trees

The banana family is a native of the humid tropical regions, Plants of this family are sensitive to frost and hence cannot be grown in the open in the colder parts of the world. The most useful member of this group is the cultivated banana tree which yields edible bananas of innumerable varieties. In our country the banana is commercially grown in southern and eastern India

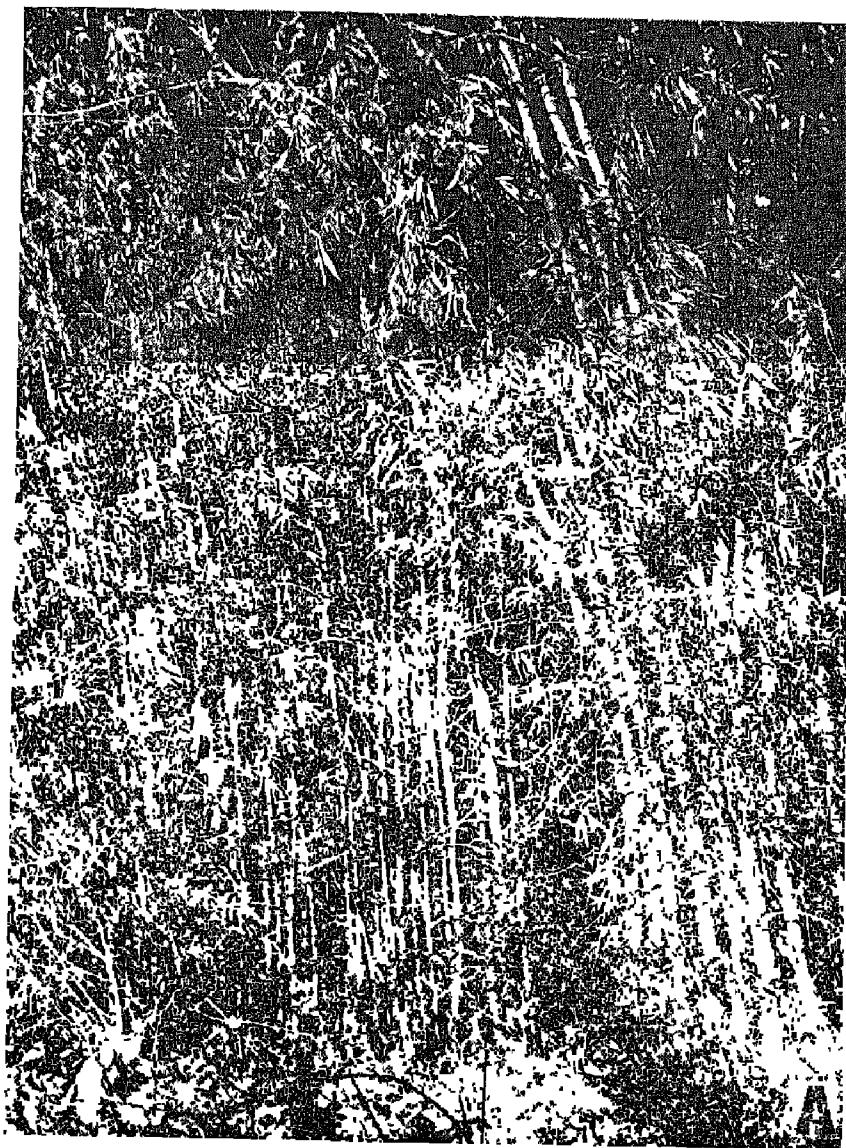


Fig. 6.6A Male Bamboo



Fig. 6.6B Thorny Bamboo



Fig. 6.6 D Golden Bamboo

where several varieties are known under cultivation and differing widely in the size, colour and flavour of the fruit. Fruits of some varieties known as Plantains do not ripen at all but remain green. These are eaten cooked as a vegetable or are converted into chips for frying.

THE BANANA TREE (*Musa sapientum*) is really not a tree but a huge perennial herb although it may attain a stature of 3-4.5 metres. The stem is not woody but fleshy and fibrous. Much of it remains underground and what looks like an unbranched trunk bearing a tuft of large gracefully arched leaves is in fact a series of tightly overlapping leaf bases. The banana leaves have neat parallel veins. They are very large, often 30 centimetres in width and up to 2 metres in length. They are simple and intact only when quite new because soon winds and storms easily tear and shred their large and thin leaf surfaces horizontally between the parallel veins and right up to the thick midrib so much so that the lowest and oldest leaves are ragged and unattractive in appearance. Just before the banana plant bears flowers it puts out a small flag leaf. The underground stem then develops an aerial shoot which grows through the hollow centre of the leaf bases and emerges as a strong thick stalk which droops under the weight of what looks like a huge bud, often purple or of a bright colour. This in fact is a series of overlapping fleshy bracts that unfold one by one to reveal a close packed cluster of numerous tubular yellowish and whit flowers which soon turn into a half circle of tiny bananas. A and when a bract falls, the next one on the opposite side starts to unfold. The huge drooping cluster continues to elongate while flowers and fruit are forming. The very tip of the bud

consists of only male flowers which therefore do not form fruit. They are hence cut off without detriment to the ripening bananas further back on the stalk and eaten cooked as vegetable. Within each banana fruit are small dark specks which are the sterile seeds. Fruits of some wild varieties of bananas do contain good seeds but these make them unpalatable.

The cultivated banana trees are propagated by root sprouts. Each tree bears only one bunch of bananas and then dies; it is cut down immediately after the fruit is gathered and new plants arise from the base of the old one.

The banana finds several uses. The ripe fruit, of course, is eaten as such and is very nutritive. The unripe fruit is an important source of food in the tropics where it is eaten as a vegetable cooked or fried in various ways. The tender white aerial stem enclosed in the leaf sheaths are cut out when the fruit bunch is harvested from the tree and is also eaten as a vegetable and, as mentioned above, the sterile male flowers are also eaten thus. The watery juice exuding from the cut ends of the stem and leaves can leave a permanent stain on clothes. In Kerala it is considered to be an antidote for snake posion.

The tender unbroken leaves of the banana make excellent, though flat, plates. They are also made into *Donas*, cup-like receptacles. On auspicious Hindu religious and social festivals they are used in both the aforementioned ways; whole plants are also used on such occasions for decoration. In Bengal, during Durga Puja the decapitated stump of the banana tree is worshipped. The peels of ripe bananas are relished by cattle but when carelessly thrown about, can be dangerously slippery, if accidentally trodden upon.



Fig. 6.7 Travellers' trees in a Madras garden

TRAVELLERS' TREE (*Ravenala madagascariensis*, Fig. 6.7), a native of Madagascar, and occasionally cultivated in our gardens and sometimes incorrectly considered a palm is also a member of the banana family. This relationship is evident from the similar size and shape of the large leaves. The Travellers' tree grows to be 6 metres in height, and is a spectacular plant. The leaves form a flattened fan-like mass of foliage, with the bases of the leaf stalks overlapping each other in a symmetrical fashion right and left alternately. These leaf bases are enlarged so that they collect great quantities of rain-water so that when the leaf stalks are cut, the water often spurts out as if a tap has been opened. Travellers have supposedly been saved from dying of thirst by finding this hidden source of water and hence the common name of the tree.

Some Common Introduced Trees

BESIDES the numerous native trees that abound in our countryside and in our forests, there are many that have been introduced from other lands in comparatively recent times, say within the past 300-400 years. Quite a few of these are grown for mere ornament because of their beautiful blossoms or for shade in gardens, parks and along avenues in many of our towns and cities. There are others that are of great economic value because of their timber, fuelwood, tannins, latex, edible fruits or seeds, and other products. The more important introduced trees will now be considered in the following pages. For convenience they are taken up in an alphabetical order of their common English names, understandably none or few of them having any vernacular names in our Indian languages.

AFRICAN SAUSAGE TREE (*Kigelia pinnata*, Fig. 7.1) owes its common name to the fact that this native of Africa bears

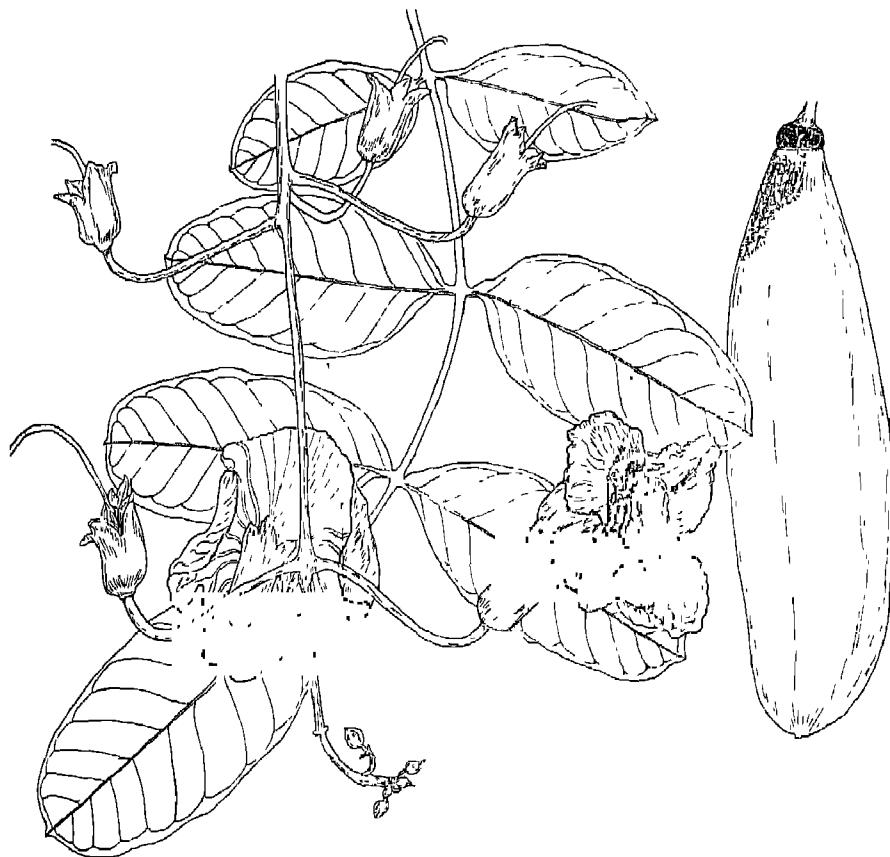


Fig 71 African Sausage tree

huge sausage-shaped fruit which hangs down in long pendent stalks. The tree is a good shade-tree for planting along avenues.

It is an evergreen bearing imparipinnate compound leaves. The large flowers which arise on long, pendent axes are crimson in colour. They bloom at night and are pollinated by bats. The fruit is large and sausage—or gourd-like in appearance and hangs down from long cord-like stalks, sometimes 2 or 3 together. Each ripe fruit may weigh several kilograms but is quite valueless. Normally this heavy fruit does not detach easily from the stalk but woe be to him who is particularly unlucky to have one land on his head.

AMHERSTIA (*Amherstia nobilis*) is one of the most beautiful among flowering trees. It is a close relative of the Flamboyant tree. A native of Burma, it is grown in many tropical countries including ours. It is a moderate-sized evergreen tree with pinnate compound leaves. The young leaves are flaccid and pendent and are remarkable for their beauty. They are at first of a rich red or purple hue before finally becoming green. The large red flowers are borne in candelabra-like racemes. Only three petals are developed but together with the pair of coloured bracts they are very attractive.

ARAUCARIAS (*Araucaria* species) are all evergreen conifer natives of the Southern hemisphere and occur in South America, Australia and the Pacific islands. The young stems are clothed with symmetrical whorled branches from the base to the summit. The spirally arranged leaves are stiff and lance-shaped on account of which even monkeys may think twice before climbing them. A South American species whose leaves are armed with sharp prickles is in fact called the Monkey Puzzle tree (*Araucaria araucana*). The male and female cones are usually borne on different trees. The seed-bearing cones which are very large take

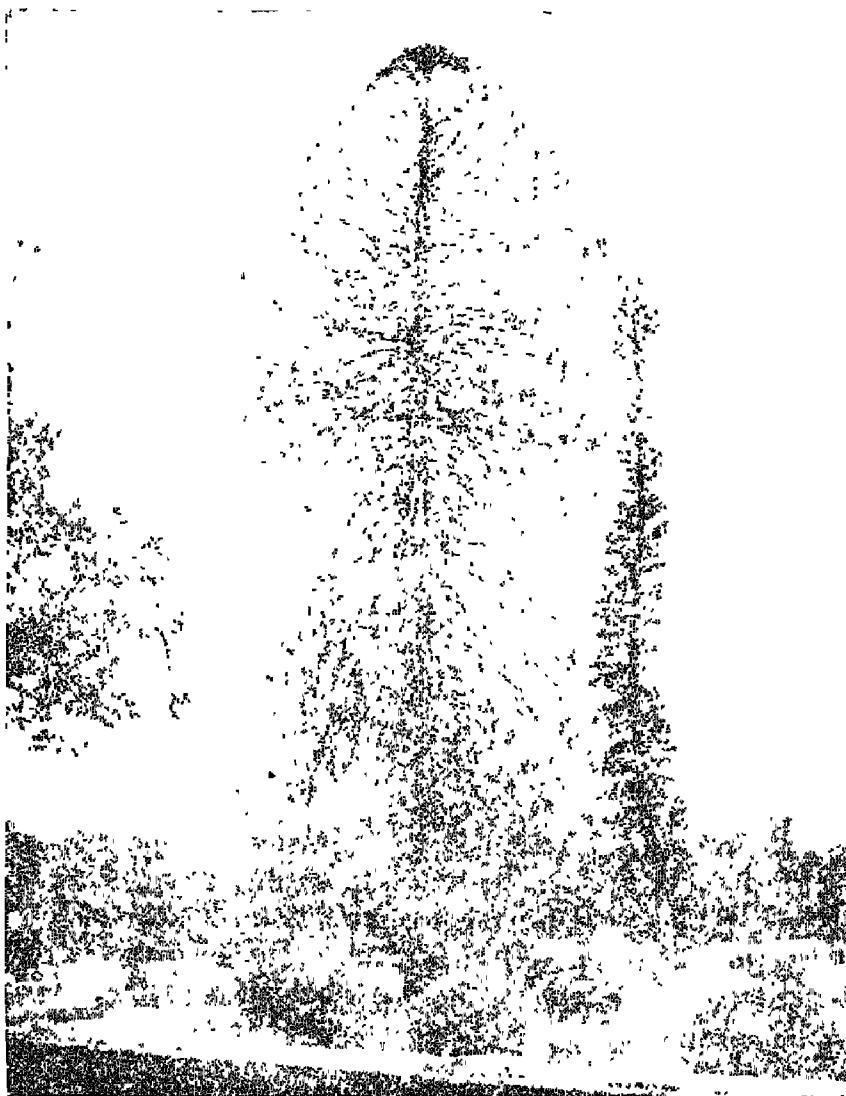


Fig. 7.2 Bunyabunya Araucaria (in the foreground) and Columnar Araucaria (in the background) at Lalbagh, Bangalore.

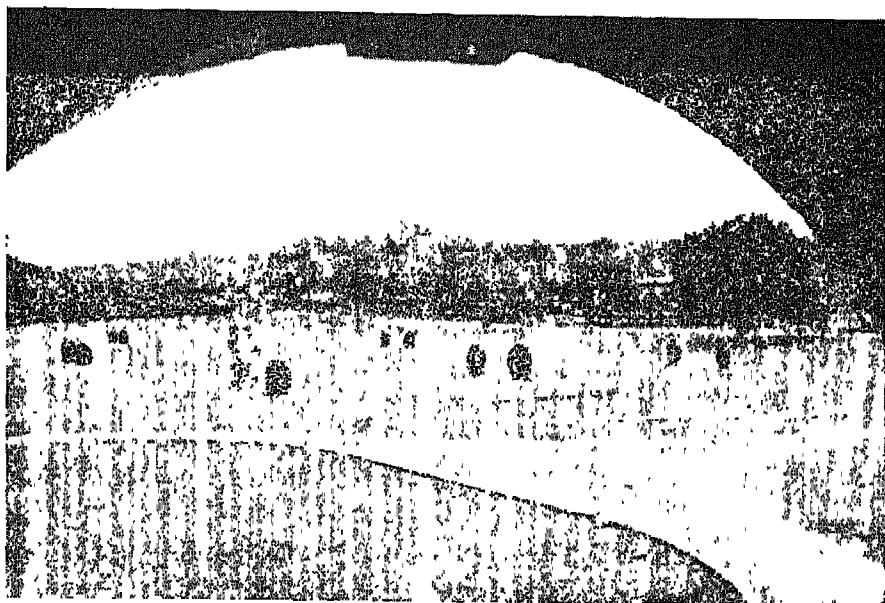


Fig. 7.3A Round domes of Arbor-vitae on a lawn

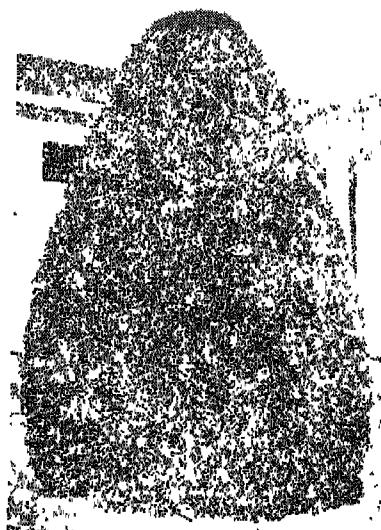


Fig. 7.3B Close-up of a single bush

2 or 3 years to mature and shed the scales along with the seed. The wood is valuable and put to a variety of uses in South America where supplies of them are abundant but in other countries including our own, the Araucarias are chiefly valued as ornamentals on account of their fine growth form. The three Araucarias commonly grown in India are the Columnar Araucaria or Cook's Araucaria, Bunyabunya Araucaria and Cunningham Araucaria also known as the Moreton Bay Pine.

COLUMNAR or COOK'S ARAUCARIA (*Araucaria columnaris*, Fig. 7.2) is a native of New Caledonia and was discovered by Captain Cook during his voyage in the Pacific. The tree has symmetrical horizontal branches. It can attain a height of 60 metres. There used to be four tall and stately specimens of this tree near the bandstand at Lalbagh in Bangalore. At one time they towered over other trees and formed a conspicuous feature of the skyline of that beautiful city. The stems of this Araucaria usually develop a slant under cultivation which adds to their graceful appearance.

CUNNINGHAM ARAUCARIA, THE MORETON BAY PINE (*Araucaria cunninghamii*) or Hoop Pine as it is called in its native Australia is similar to the Columnar Araucaria in general habit but in young trees the bark is papery and flakes off horizontally. It is a native of the coastal districts of Queensland in Australia and its seeds form an important food of the aborigines there.

BUNYABUNYA ARAUCARIA (*Araucaria bidwilli*, Fig. 7.2), unlike the two preceding species, has a symmetrical dome-shaped or pyramidal habit. There are some nice specimens of this species also at Lalbagh in Bangalore. The lateral branches

of this tree are long and pendent and the leaves broad and flattened.

ARBOR-VITAE or THE COMMON THUJA (*Biota orientalis*, Fig. 7.3A,B) of our gardens, originally a native of North and West China, has been long under cultivation in many other parts of the world. It is a small shapely tree but is often kept pruned down to dome-like bushes in gardens. In general appearance it recalls the Cypresses to which all the Thujas are in fact closely related among the Gymnosperms. The vertically arranged fan-like branchlets bearing small scale leaves give this plant its common Hindi name, *Morpankhi*, meaning peacock fan. The male cones are cylindrical and terminate the ultimate branches whereas the round female cones develop lower down. The cone scales of the latter are strongly hooked when young. The shapely crown of this plant is highly ornamental and the fan-like branchlets are often used as background to flowers for button-holes.

ARNOTTO or ANATTO DYE TREE (*Bixa orellana*, Fig.

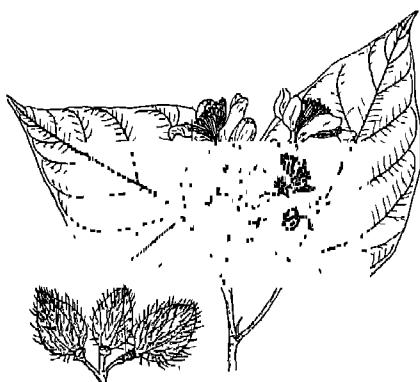


Fig 7.4 Arnotto Dye tree

7.4) has long been under cultivation in India and is sometimes found naturalized in this country. It is a small-sized tree. The flowers are showy. Its fruit capsules are reddish-brown in colour and are covered with prickles. From the coloured seed coats is obtained a yellow dye which is good for colouring cheese and butter.

AUSTRALIAN BLACKWOOD TREE (*Acacia melanoxylon*, Fig. 7.5) is a very common tree in the Nilgiris, so common indeed as to appear a native of that region. However, it is not so. It was introduced there from Australia about a hundred years



Fig 7.5 Australian Blackwood tree

ago as a timber and fuelwood tree like some other common introduced trees of that area, namely the Blue Gum Eucalypt and the Wattles. It is related to the Wattles and to our native Babul and Cutch trees but unlike all of them it has its leaves

metamorphosed into flat, parallel-veined, sword-shaped structures known as phyllodes. True leaflets are only occasionally seen on young plants but soon drop off leaving behind the green phyllodes to perform the function of food manufacture. The flowers are bright-yellow and occur in small heads. A few other phyllode-bearing related species such as *Acacia auriculiformis* are grown for ornament in our gardens.

BOTTLE-BRUSH TREE (*Callistemon citrina*, Fig. 7.6; *C. viminalis*) is so named because its flower-bearing spikes strikingly recall a bottle-brush in appearance. The long stamen filaments stand for the bristles of the brush and the cluster of small leaves at the summit of the spike recall its tuft. This small tree, a native of Australia, is often planted in Indian gardens for ornament and bears gorgeous crimson-red flowers which are much sought after by bees.

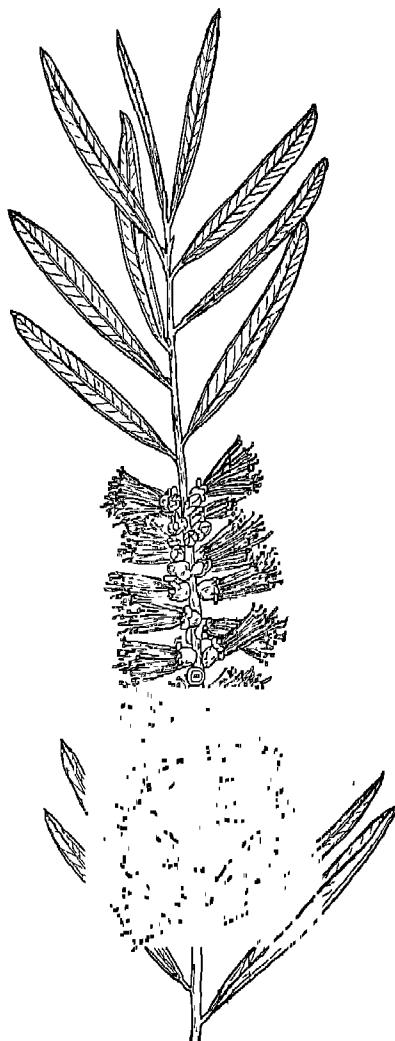


Fig. 7.6 Bottle-brush tree

BREADFRUIT TREE (*Artocarpus altilis*) is a relative of our native Jackfruit but its fruit is smaller and can be eaten only when cooked. The tree is a native of the islands in the Southern Pacific and it was during the first attempt to introduce it in the West Indies in the 18th century that the now historic affair of 'Mutiny on the Bounty' arose. The tree has deeply incised but simple leaves and is frequently grown in the South for its vegetable fruit. Both seedless and seed-bearing varieties are known.

CALLITRIS (*Callitris cupressiformis*) is an ornamental conifer with Cypress-like foliage. It was introduced into India about 1885 and now covers considerable areas in the Nilgiri hills where its resinous wood is mainly used as fuel.

CANNON BALL TREE (*Coroupita guianensis*, Fig. 7.7) is a native of tropical South America. It is usually grown near Saivite temples in South India since the devout hold this tree in religious veneration for reasons to be mentioned presently. Its large attractive multicoloured flowers arise on the older woody branches. The peculiarly shaped bundle of fertile stamens rising from one side of the flower curves back over the ovary and style. The devout see in the stamens and the ovary the many-headed cobra brooding over the lingam-stone and hence the name *Naga-linga pushpam* for the flower. The barren stamens surround the ovary as a ring. The brown fruit that later follows the flowers on the woody branches is very large and globular and the size of Cannon balls of olden days. It contains inside a pulp with a disagreeable odour.

CARAMBOLA or KAMRAKH (*Averrhoa carambola*, Fig. 1) whose native home is not known for certain, is widely cultivated for its sour-sweet sharply angled edible fruit which is

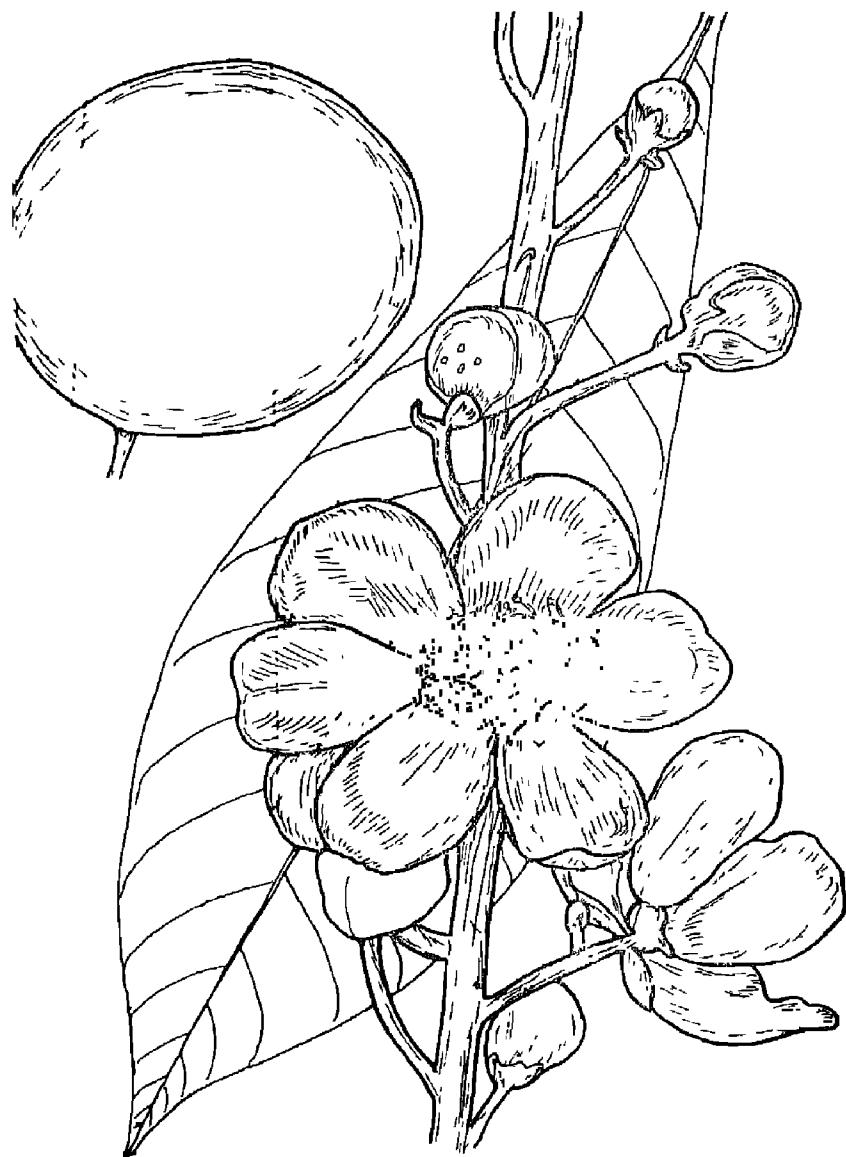


Fig. 7.7 Cannon Ball tree



Fig. 7.8 Carambola

used for making jellies, preserves, pickles etc. The unripe fruit is cooked as curry. Carambola crush can be a refreshing drink. A close relative Bilimbi or Tree Sorrel (*Averrhoa bilimbi*) also yields edible fruit which hangs like miniature cucumbers from the trunk and branches and gives it another name the Cucumber tree. They have smoother angles than the fruit of the Carambola.

CASHEW-NUT TREE (*Anacardium occidentale*, Fig. 7.9) is a very useful one introduced from its native South America into 16th century India by the colonial Portuguese. It is now naturalized in South India where it thrives especially well along the coast on sandy soil and in non-frosty climates. From the West coast districts large quantities of Cashew-nut are annually exported to America earning valuable foreign exchange

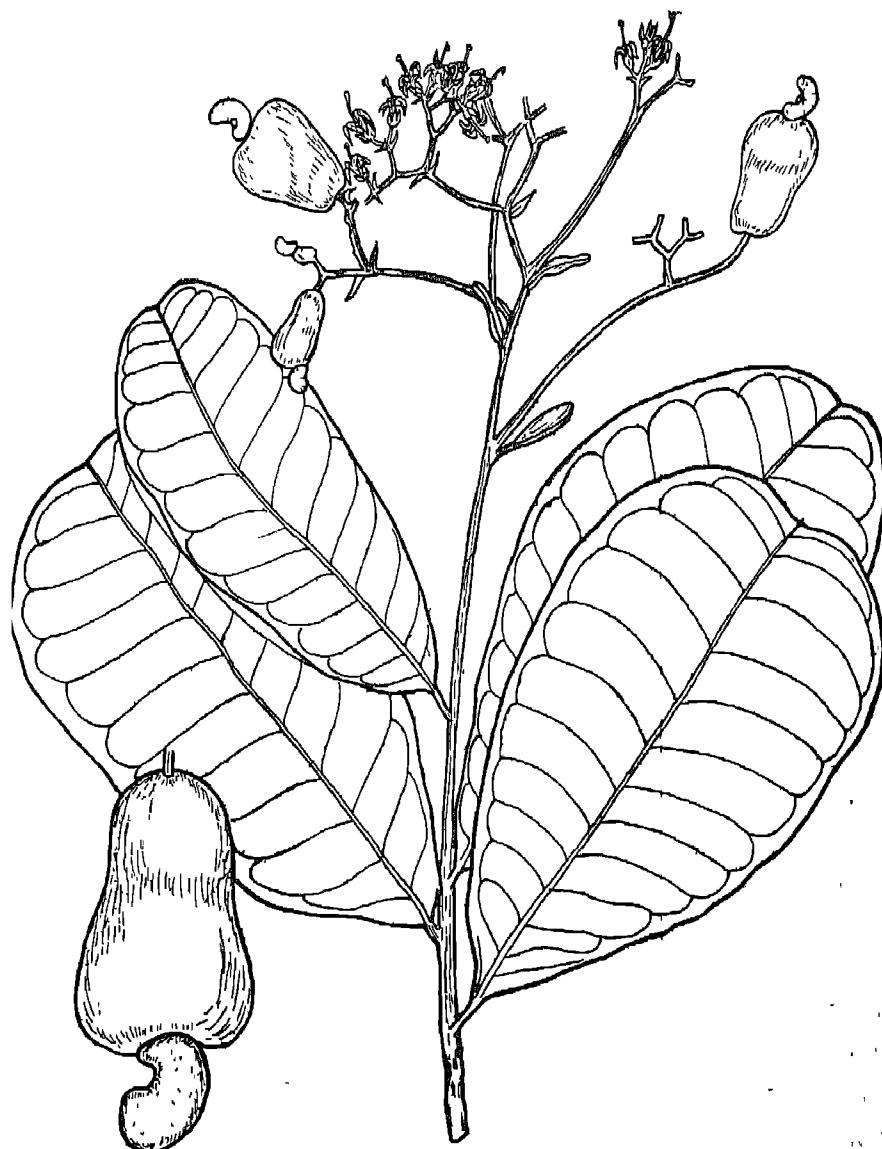


Fig. 7.9 Cashew-nut tree

for our country. The Cashew belongs to the same plant family as the Mango and the Dhoby nut and is a small spreading evergreen tree with a thick crooked trunk. The leaves are simple, egg-shaped and leathery to touch. The flowers are small and occur in loose leafy clusters. One of the 8-10 stamens in a flower is much larger than the rest. What is mistaken for the brightly coloured fruit and is called the Cashew apple is actually only the fruit stalk which becomes swollen and when unripe contains a highly acrid juice. The real fruit or nut is the kidney-shaped body seated on the top of this fleshy mass and containing the creamy edible seed made of two kidney-shaped halves. The harvested nuts are first roasted and then the shells removed by hand to separate the kernels. Like the almond, the Cashew seeds are a rich concentrated food with a pleasant taste and flavour. They are eaten often roasted and salted. Large quantities are consumed in the making of sweetmeats and in confectionary. The by-products of the Cashew-nut industry like the oil exuding while roasting the raw nuts find many uses and hence largely exported. Some people are allergic to the acrid juice contained in the unripe Cashew fruit as well as to the oil from the roasted shells of the nuts. The tree is also useful for afforestation of coastal sand dunes. The timber is used for boat-building.

CINCHONA or QUININE TREE (*Cinchona* species, Fig. 7.10) is, as it were, a boon tree from the New World which has saved untold thousands of lives from the once dreaded disease, Malaria. The drug quinine is extracted from its bark. In our country the tree is cultivated mostly in Darjeeling and Nilgiris. The Cinchona belongs to the same plant family as the Coffee bush but is put to a different and perhaps more humane use.



Fig. 7.10 Cinchona

Especially during World War II when some of the world's rich Cinchona growing areas were temporarily lost to the Japanese, many synthetic drugs were used as substitutes for the treatment of Malaria but these have not been able to completely oust the natural plant product.

COLVILLE'S GLORY (*Colvillea racemosa*) is a small-sized tree much like the Flamboyant tree in its leaves and general appearance. The racemes of orange-scarlet flowers are borne well above the leaves and are very striking. It is common in Bangalore as an avenue tree.

CRYPTOMERIA (*Cryptomeria japonica*) is a c
duced by seeds from Japan about the middle of ^{the} 19th century. Its cultivation was started around Darjeeling

now extensive forests of this tree. It has also been introduced in parts of the Western Himalayas.

CUSTADR APPLE TREE (*Annona squamosa*, Fig. 7.11) which does not appear to be a real native of India is naturalized in our country in some parts of which its delicious fruit goes under the name of *Sitaphal* while in others it is called *Sharifa*. This and



Fig. 7.11 Custard Apple

all its other relatives like the Bullokov's Heart (*Annona reticulata*) and Cherimoyer (*Annona cherimolia*) which are respectively known as *Ramphal* and *Hanumanphal*, originally belong to tropical America and the West Indies although it is inexplicable

how certain ancient sculptures of our land have depictions of a fruit closely recalling the Custard Apple, which is a good example of a collective fruit. It is made of a number of one-seeded bits fused together and containing a delicious, richly flavoured custard-like edible portion and flat, shiny seeds. In Cherimoyer the fruit has a spiny surface. It is sour to taste.

CYPRESSES (*Cupressus* species) of which only one is really a native of the Himalayas, are ornamental because of their foliage and on that account many of them have been introduced and grown in our gardens. The Mediterranean Cypress (*Cupressus sempervirens*) can be grown both in the plains and the hills and mountains. The tall Columnar variety (var *pyramidalis*, Fig. 7.12A) is extensively cultivated in the plains and good specimens of it can be seen especially in old gardens. The familiar vista of shapely green trees along either side of the fountains in the forecourt of the world famous Taj Mahal in Agra and other old monuments in Delhi, Srinagar and elsewhere consist of trees of this Cypress. The tree grows very slowly but can live up to a great age. The Weeping Cypress or Mourning Cypress (*Cupressus funebris*, Fig. 7.12B), a native of China, is grown chiefly near temples and monasteries in the Eastern Himalayas, also often in graveyards and cemeteries. It has a drooping habit symbolising sorrow and its long branchlets form flat sprays. The Monterey Cypress (*Cupressus macrocarpa*) which in nature has a very restricted distribution along the coast of California and Guadalupe islands has grown well in the Nilgiri hills. The high altitude Kashmir Cypress (*Cupressus cashmeriana*, Fig. 7.12C) of Tibet has not only survived but has grown surprisingly well at Dehra Dun (altitude 730 metres) where there



Fig. 7.12A Mediterranean Cypress
(columnar variety)

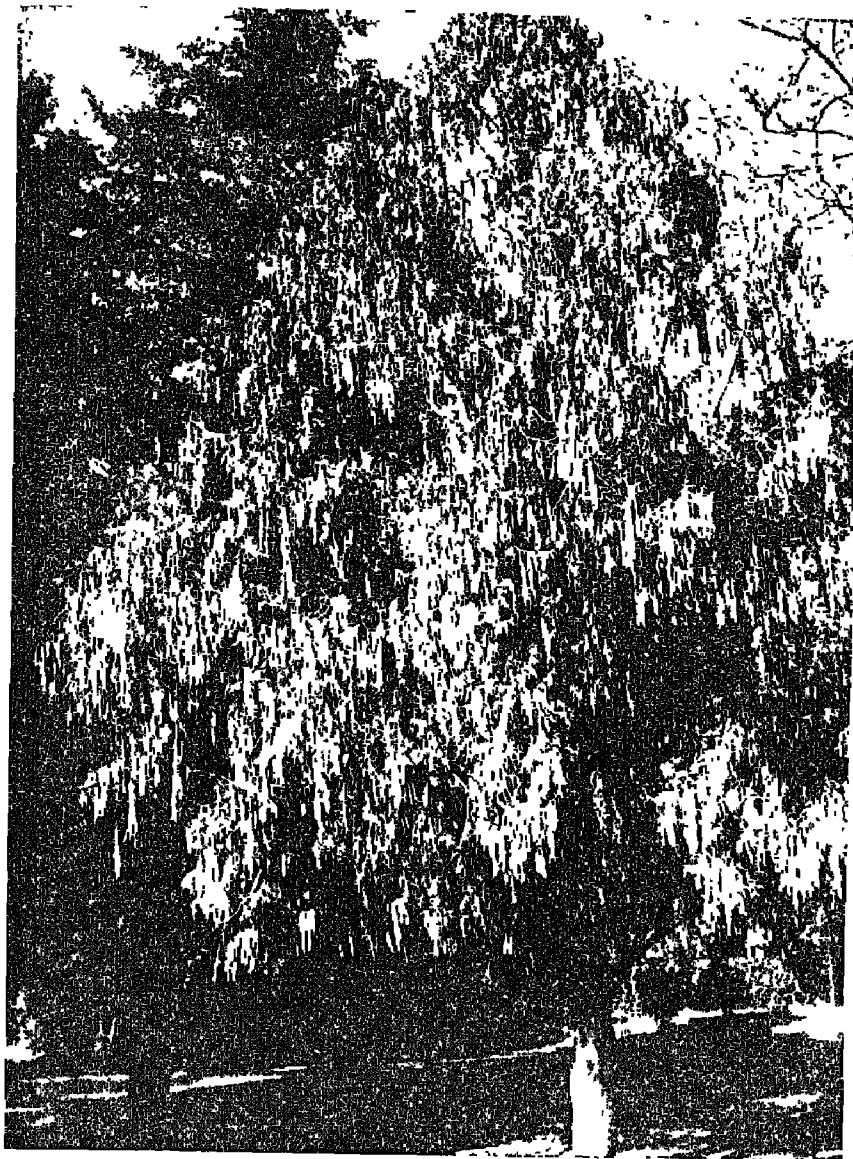


Fig 7.12B Weeping Cypress

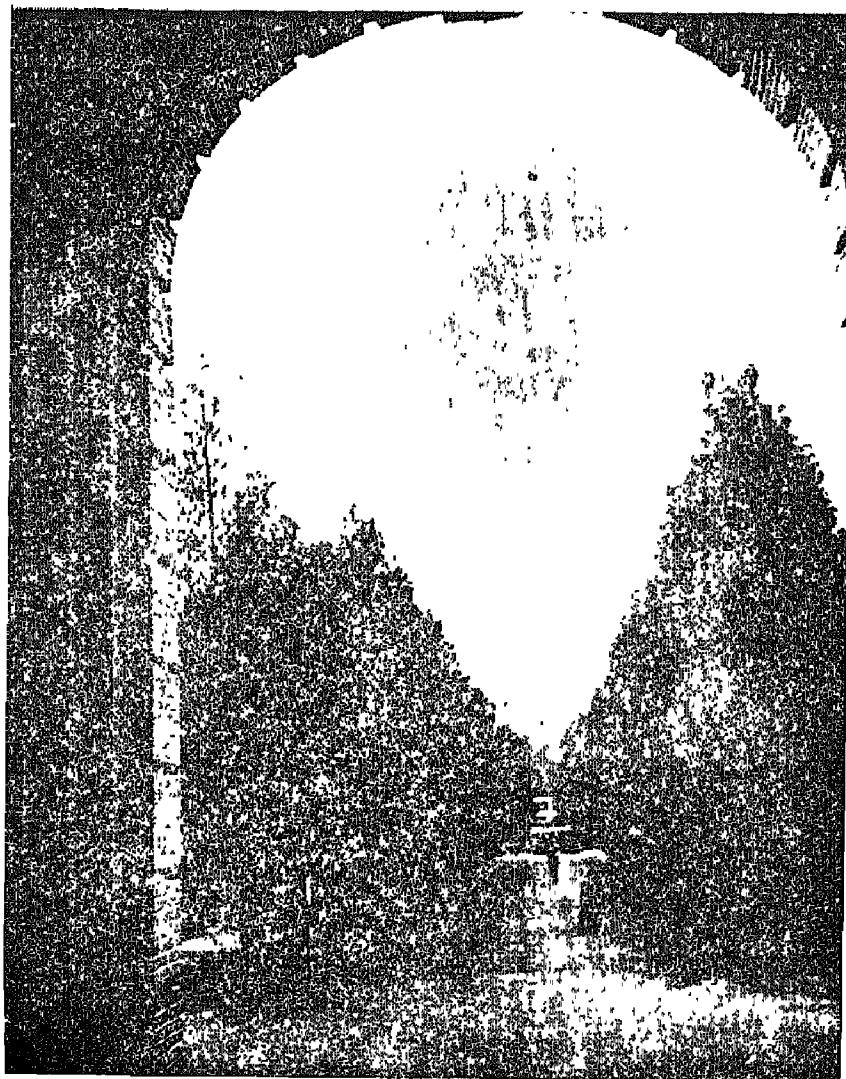


Fig. 7.12C An avenue of Kashmir Cypress
at New Forest, Dehra Dun

is a graceful avenue of it at New Forest. The Mexican or Goa Cypress (*Cupressus lusitanica*) is commonly grown in Western India.

EUCALYPTS (*Eucalyptus* species, Fig. 7.13) are characteristically Australian trees much like the Kangaroo which is found only on that continent. There are some 400-500 different kinds of this tree some of which have been planted on a large scale in many parts of the world. One of the most familiar of the Eucalypts introduced in our country is the Blue Gum Eucalypt (*Eucalyptus globulus*) in the Nilgiris where it has grown even better than many of the native trees. The lemon-scented Eucalypt (*Eucalyptus citriodora*) is one of the more widely grown ones in our country. In all Eucalypts, peculiar cap-like structures conceal the essential reproductive organs in the flower. When the flowers open they neatly come off as lids and are cast away. The term Eucalyptus in Greek means 'I enclose' referring to this unique lid. The outer bark of Eucalypts quickly peels off revealing a smooth grey surface. One of the largest trees in the world is an Eucalypt in Australia. The leaves contain oil-secreting glands in their tissues and when crushed give the distinctive smell.

The wood of Eucalypts is valuable and the Eucalyptus oil is distilled out of the aromatic leaves of some of them. Because of their fast growth rate many Eucalypts have found favour with our forest departments which have raised large plantations to provide plenty of fuelwood. They are also good for afforestation to prevent soil erosion. There is a future possibility of their providing pulpwood for our paper and other pulp-based industries.

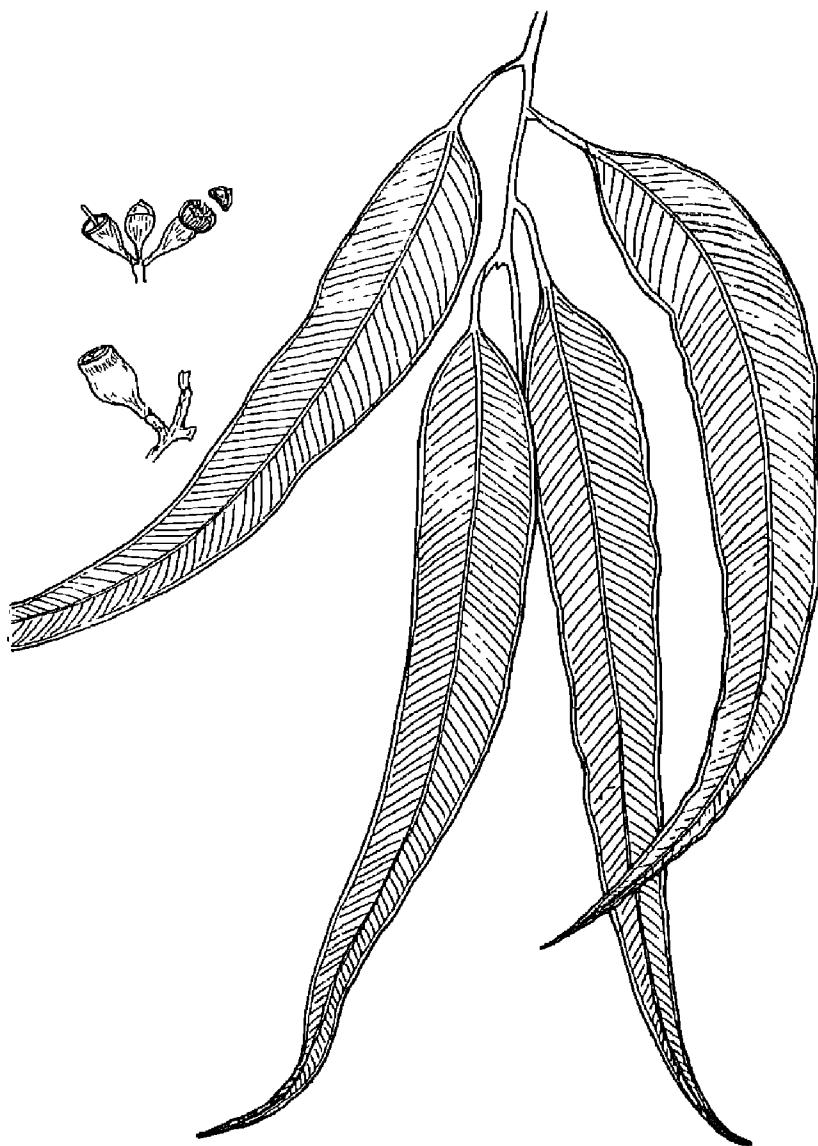


Fig. 7.13 Eucalypt

GONG-STICK TREE (*Parkia biglandulosa*), a native of Malaya, is grown in gardens and on roadsides in many parts of our country but especially in the South. It has the nice umbrella-like habit of our native *Siris*. The leaves are twice pinnate with numerous crowded pairs of small leaflets. The flowers are small, cream-white and densely crowded in large knob-like heads the size of an orange and hang down at the extremities of long hairy stalks. These long stalks with the flower heads at their ends look much like drumsticks or gong-sticks and give the tree its common name. Naturally, when the pods are formed they dangle at the ends of these stalks in clusters.

GUL MOHUR, THE FLAMBOYANT TREE, or GOLD MOHUR (*Delonix regia*, Fig. 7.14) is an exotic from Madagascar often planted for avenues and for ornament in many parts of India. The large feathery leaves are bicompound and the leaflets are small and oblong in outline.

The tree presents a gorgeous appearance when it is in profuse bloom early in the hot season when it has shed nearly all of its foliage. The flowers are deep-red or orange but for a single small petal which is

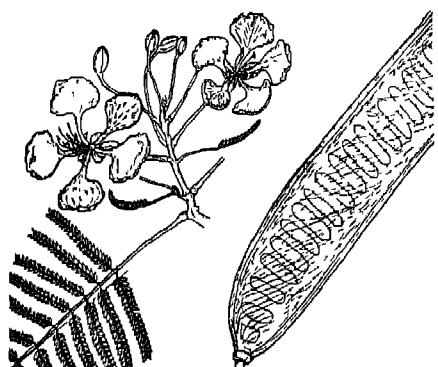


Fig 7.14 Flamboyant tree

variegated and prominently stands out like a flag to attract insect pollinators. The flower is also called Peacock flower like those of another garden shrub. The pods are large, flat and sword-like.

GUAVA (*Psidium guajava*, Fig. 7.15), a common fruit in our market and of which some good varieties like the popular

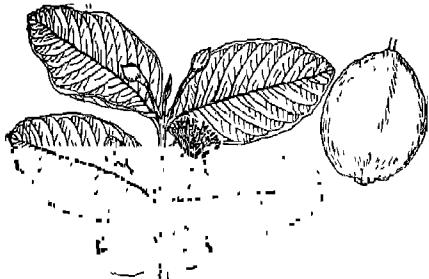


Fig. 7.15 Guava

Allahabadi are in cultivation for long in our country is not really a native tree but one that was introduced from tropical America a couple of centuries ago. It is a small-sized tree with smooth stems from which the bark readily peels off as papery scales. The fruit has a core of hard seeds embedded in an edible pulp which is white and in some varieties coloured red.

The fruit is eaten raw as also made into jams and preserves.

JACARANDA (*Jacaranda mimosifolia*, Fig. 7.16) meaning in Latin the mimosa-leaved Jacaranda, has leaves which may easily be mistaken for those of the Flamboyant tree or some other leguminous tree, but its flowers are quite different. They are tubular in structure and blue-mauve in colour. When in flower in the hot season this is a very beautiful tree and is hence good for planting in the ornamental garden or along avenues. Originally a native of Argentina it is introduced in many warm countries. In fact it is considered to be one of the best ornamental flowering trees of the tropical and subtropical regions. Its flat disc-like fruit bursts open to reveal winged seeds.

LITCHI (*Litchi chinensis*, Fig. 7.17) is an exotic fruit tree much cultivated in parts of Bihar and Western Uttar Pradesh. From a distance the Litchi trees can be mistaken for the Mango trees like which they are also evergreen. The Litchi tree flowers and



Fig. 7.16 Jacaranda



7.17 Litchi

fruits during the hot season. The fruit has rough brittle skin which on removal reveals the delicious white aril within, covering a single large seed.

LOQUAT (*Eriobotrya japonica*, Fig. 718) which is said to be a native of Japan is widely cultivated in Northern India and less commonly in the South, for its sour-sweet fruit which is sold



Fig 7.18 Loquat

in the fruit market during the hot season. Its leaves are elliptical and are crowded near the ends of the shoots. Both are

very densely brownish hairy. The flowers arise in loose clusters. The fruit is orange-yellow in colour and sour-sweet to taste.

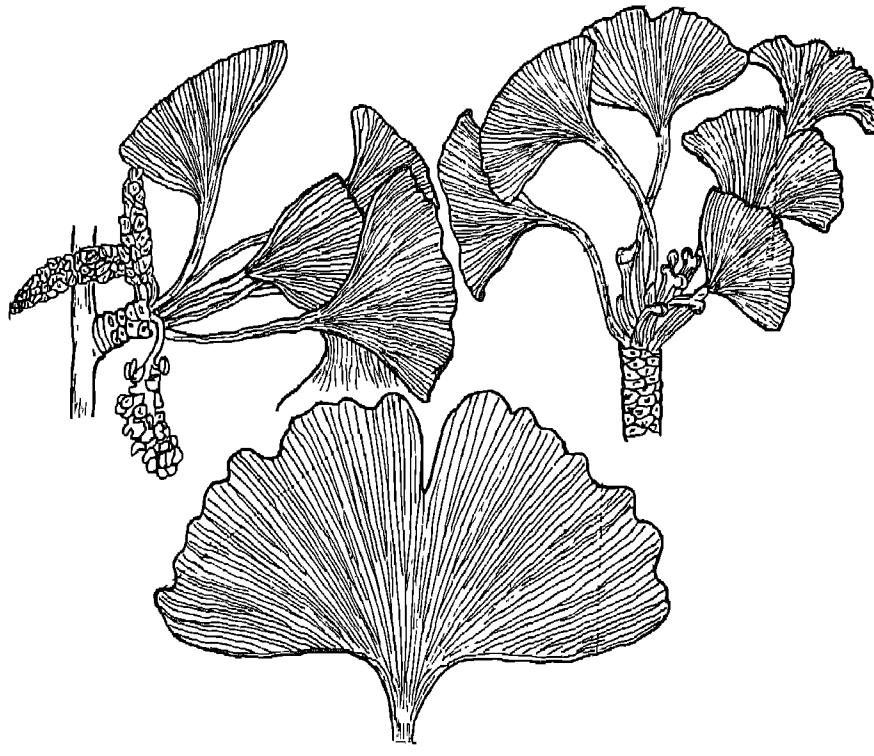


Fig. 7.19 Maidenhair tree: leaves, male and female cones

MAIDENHAIR-TREE or GINKGO (*Ginkgo biloba*, Fig. 7.19) is of unusual interest to botanists because of several reasons. It is the sole survivor of a once widespread but now extinct race of trees and is hence called a 'Living fossil'. Before the last ice

age of the earth's history it was widely distributed and the fossil Ginkgo leaves look almost exactly like those of the living trees. Today it is known mostly as a cultivated tree even in its present limited native home in China and Japan. It is thought that the preservation of this tree to our day may be traced to the interest taken in it by the Buddhist priests who carried it about from place to place. Many very old and fine specimens are said to exist in the precincts of Chinese and Japanese temples.

The Ginkgo is a deciduous tree like the Larch and unlike the majority of conifers. It has thin fan-shaped leaves with beautiful nervation resembling those of the Maidenhair fern of gardens. The male and female cones arise on different trees. The wood is light and yellow in colour. In China and Japan it is said to be used for chess boards, chess pawns, chopping blocks and for fire-wood. Its seeds are eaten in these countries. There are only a few trees of Ginkgo under cultivation in India where it is not easy to grow them in the hot plains.

MESQUITES or MESQUITS (*Prosopis juliflora*, *P. glandulosa*, etc., Fig. 7.20) are spinous American trees related to and resembling our native Indian Mesquite. They have been introduced more or less naturalized in Punjab, Rajasthan and elsewhere. One of them is deciduous, the other evergreen. They are grown as a tree, shrub or hedge. Cattle do not touch them but the ripe pods are a good fodder. In fact they are largely consumed in their native habitats by Mexicans who grind them into coarse flour which is eaten cooked or a fermented liquor is brewed out of it. There are several forms of Mesquites : some of them are excellent for afforestation of arid areas.

for fixing drifting sand dunes as has been done in the Rajasthan desert where they can provide much needed fuel and fodder.

MORETON BAY CHESTNUT (*Castanospermum australe*) is grown in gardens for its pretty orange-yellow flowers. The swollen woody pods have chestnut-like seeds inside.

PAPAYA (*Carica papaya*, Fig. 7.21) is commonly grown for its fruit in homes and gardens in the South. Being a tropical tree from Mexico and the West Indies it cannot stand well the cold frosty winters of the North. The tree is a rapid grower and comes to bearing in a year or so after sowing the seeds. It continues to bear them in such abundance that thinning is frequently necessary to ensure that the ripe fruit has the proper size and shape. The Honey Dew and Washington are the two choice varieties under cultivation. The tree has somewhat the appearance of a palm, the stem being usually unbranched and bearing a crown of large palmately dissected leaves with long hollow tubular stalks. The younger parts of the stem are prominently marked with wedge-shaped leaf scars. All parts of the tree contain a white milky latex and the stem is made of a soft fibrous tissue that is prone to attack by a fungus which causes the trunk to rot away. In this tree as in some true palms the male and female flowers are usually borne on separate trees so much so that if you happen to have only a male tree in your backyard you will find that it will bear flowers but yield no fruit. The fruit arises closely packed at the bases of the leaf stalks. It should be plucked as soon as the skin begins to turn yellow. The ripe fruit is sweet and delicious to eat. The unripe fruit and even leaves and pith are eaten cooked as vegetables. The seedless varieties of the fruit are known. When

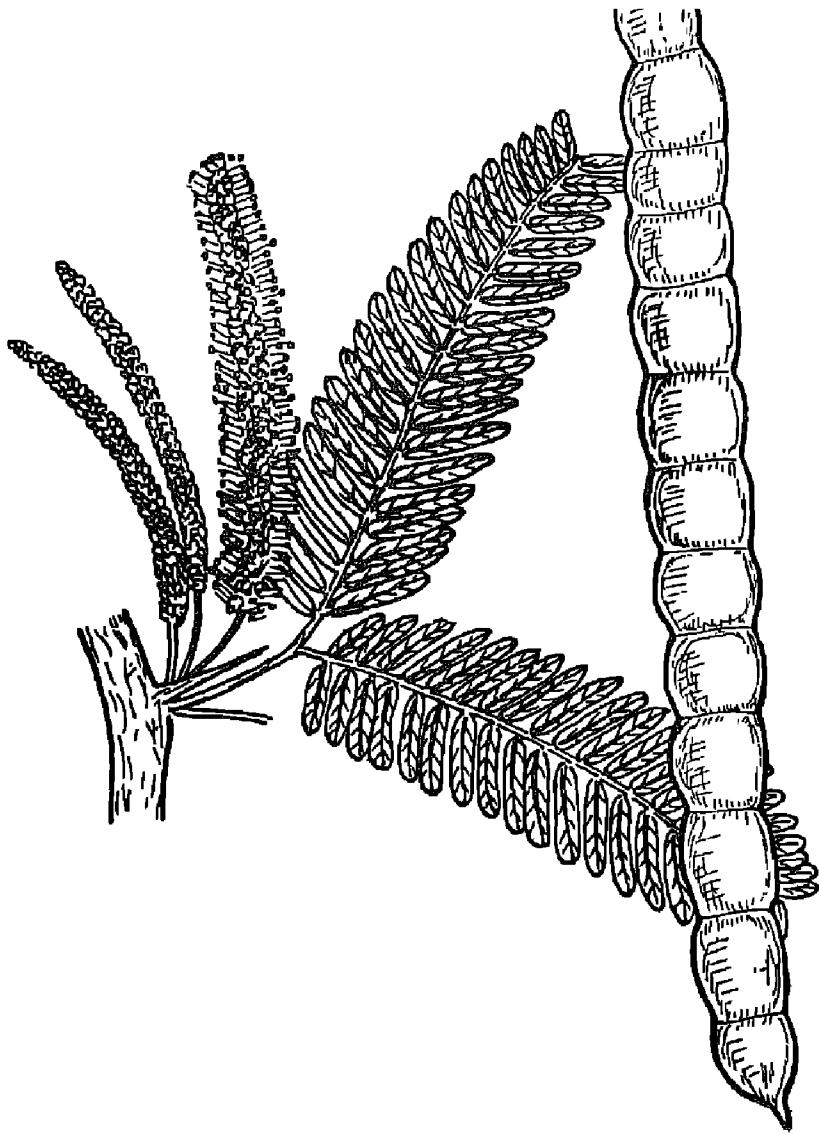


Fig. 7.20 Mesquite

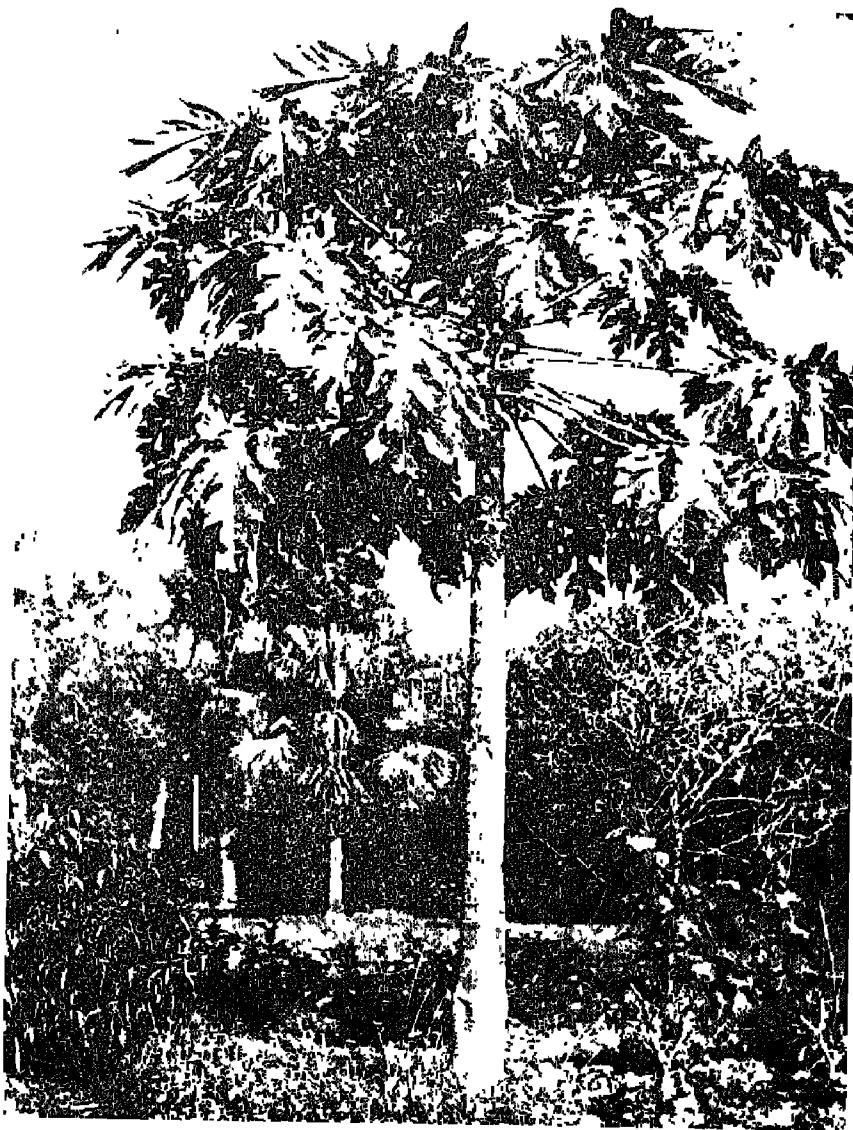


Fig 721 Papaya tree

an incision is made on the unripe fruit plenty of white latex oozes out and solidifies on the surface. The latex finds several medicinal uses. Among other things it is considered to be one of the best vermifuges. Papain is made out of it which is used for tenderizing meat and in chewing gums.

PEPPER TREE OF PERU (*Schinus molle*) belonging to the Mango family is sometimes planted for ornament in gardens for its drooping branches that give it a weeping effect like those of the Weeping Willow. In fact the weeping effect here is heightened by the long pinnately compound leaves which also hang downwards. The flowers are small and inconspicuous but the small berries when ripe recall red beads. The foliage when crushed has a pungent odour which probably gives this tree its common name.

PINK CASSIAS (*Cassia* species, Fig. 7.22) are related to our native Indian Laburnum but unlike it, bear pink-rose-red flowers. Some of them can cross with the Indian Laburnum but flowers of the resulting hybrids are not as attractive as those of either of the parents. The Pink Cassias are among the most beautiful tropical trees when in bloom. Some five kinds of them are introduced into our country. They are excellent for growing in gardens and for avenues. They are small and mostly deciduous trees with a spreading crown. The leaves are pinnately compound with medium-sized oblong leaflets. The flowers arise in the hot season and the trees are in full bloom when practically leafless. The stamens are yellow and the interesting feature about them is that in the same flower they are of different sizes and shapes. The three largest stamens are curved in the form of the letter "S" and in the Nodose Cassia (*Cassia nodosa*),



Fig. 7.22 Pink Cassia

Java Cassia (*Cassia javanica*) and Burmese Pink Cassia (*Cassia renigera*) and some others the filaments of these stamens have a curious swelling about their middle. The flowers of the Red Cassia (*Cassia marginala*) are smaller, salmon pink in colour, the pink becoming deeper as the flower ages. The pods of all of the aforementioned Cassias are long, slender, cylindrical with transverse partitions between the seeds.

RAIN TREE (*Samanea saman*, Fig. 7.23) bears a neat umbrella-like crown. It is a native of tropical America first introduced into Sri Lanka for railway fuel. The leaves are twice pinnately compound and closely recall those of our native *Siris*. They show a remarkable power of changing their position according to



Fig. 7.23 A Rain tree twig

the prevailing atmospheric conditions. In full sunshine they spread out horizontally but at night, in dull cloudy weather or during rain the pairs of leaflets fold together, the leaf stalks droop and the entire leaf seems to fall 'asleep'. The Tamil name, *Toongu moonji* meaning sleepy faced thus seems appropriate for this tree. In Malaya this drooping of the leaves is considered to portend rain. This circumstance as well as

the curious habit of this tree to spray the ground beneath with moisture give it its common name of Rain tree. This spray, it was later discovered, was caused by multitudes of min-

insects. The tree produces puffs of pink flowers during the season. The stamen filaments are thread-like.

The Rain tree is planted along roads in warmer parts of India particularly for shade and for ornament. Its pods contain a sweet edible pulp and are liked by cattle.

ROBINIA or LOCUST TREE (*Robinia pseudacacia*, Fig. 7.24), a native of North America, was introduced in the Punjab and Kashmir Himalayas towards the end of the last century. It flourishes there providing valuable fuel. It is also useful for clothing bare slopes and for fixing unstable ground.

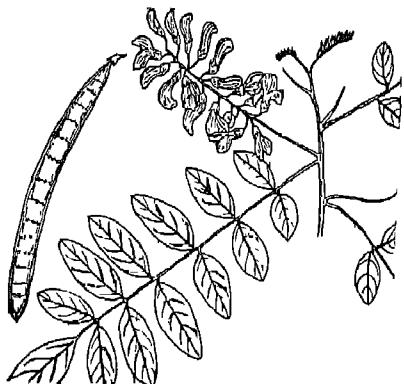


Fig. 7.24 Robinia

RUBBER TREE (*Hevea brasiliensis*, Fig. 7.25) is one of the most useful trees cultivated in the world today because it is the chief source of natural rubber.

It is a native of the Amazon forests of South America but today Malaya is the largest grower of this tree and the chief exporter of its product. In our country rubber plantations are raised in the wet forests of Kerala where the climate is ideally suited for its growth. The tree yields plenty of white latex which is tapped by making V-shaped incisions on the trunks. Dried and chemically treated, it gives the all too familiar rubber which is put to a variety of uses in modern times, for the tyres and tubes of bicycles, motor-cars, trucks and so on.

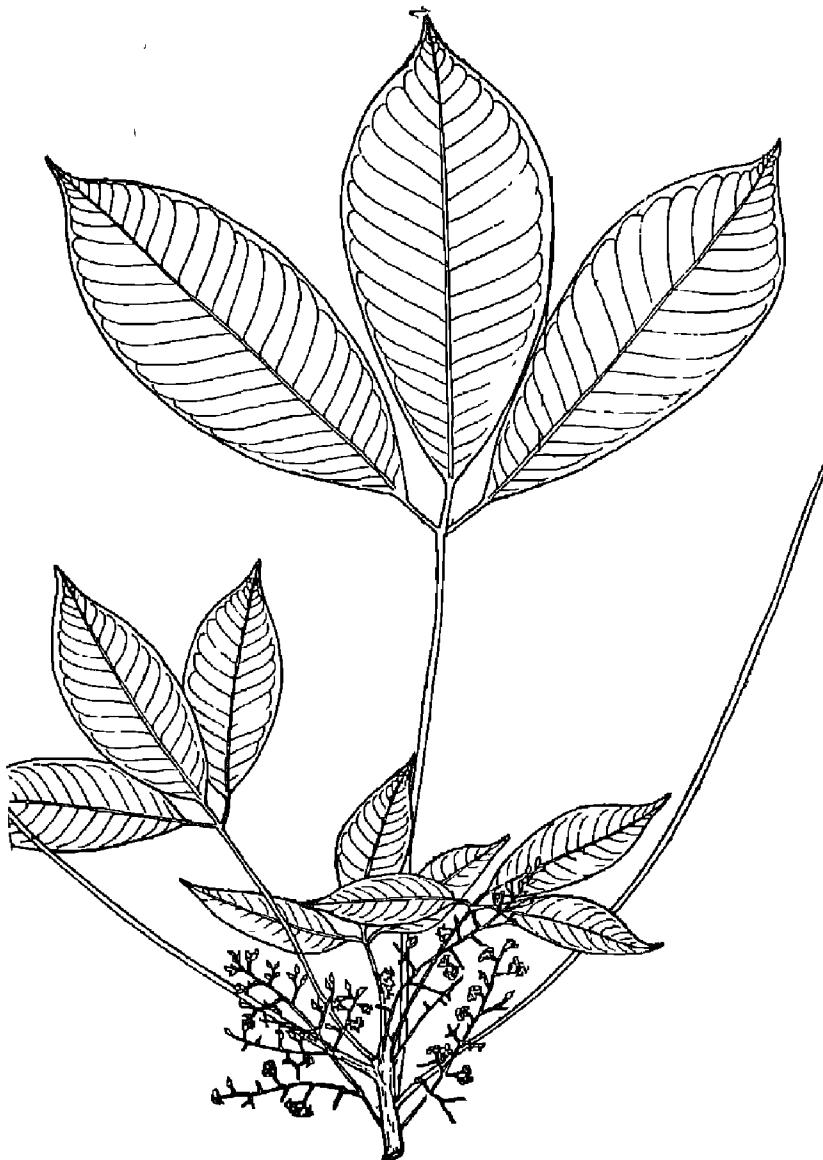


Fig. 7.25 Rubber tree

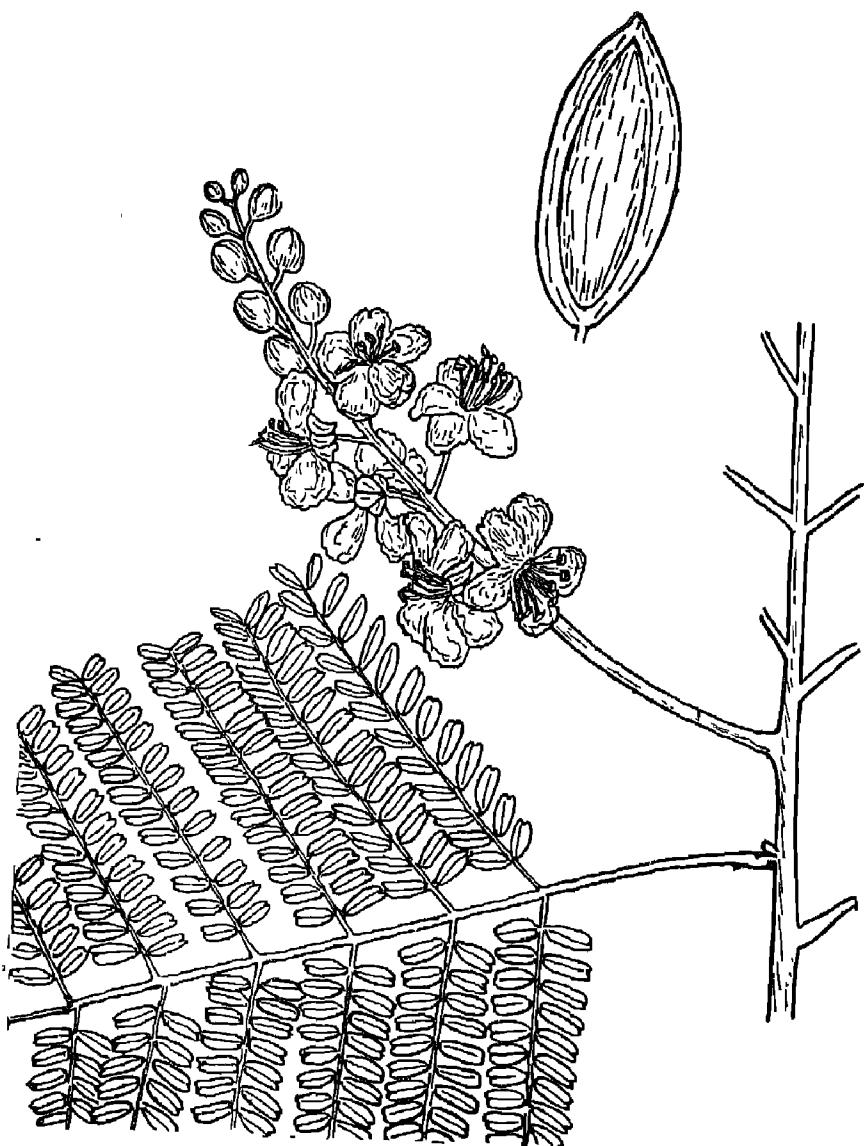


Fig. 7.26 Rusty Shield Bearer

RUSTY SHIELD BEARER or **COPPER-POD TREE** (*Peltophorum pterocarpum*, Fig. 7.26) bears bright yellow and rusty red pyramidal clusters of scented flowers. The petals are crinkled and their bases are covered with rusty hairs. The anthers are orange-red; the sepals and the shield-shaped, flat pods are coppery-red. The large, fern-like leaves are bipinnately compound with large, oval leathery leaflets. The tree is much grown for ornament in our country and forms a striking avenue if planted alternately with the Flamboyant tree. It is a native of Sri Lanka, Andamans and Malaya.

SAPOTA or **SAPODILLA** (*Achras zapota*, Fig. 7.27) is an introduced tropical American tree that is chiefly grown in the coastal areas of Maharashtra, Tamil Nadu and Bengal for its delicious fruit which is a round or oval berry of varying size. It has a deep-brown skin like a potato and a light-brown sweet flesh within. The seeds are large, flat and shiny-black in colour. The unripe fruit is sticky and unpalatable. The coagulated resinous latex or "Chickle" obtained from the bark of this tree is much used in the United States of America in the manufacture of chewing gum, and as a cement for joining small articles and in dental surgery.



Fig. 7.27 Sapota

SILKY OAK or **SILVER OAK** (*Grevillea robusta*, Fig. 7.28) is not a true oak. A native of Australia, it is widely grown



Fig. 7.28 Silky Oak

our country for ornament and as a shade-tree especially in Tea and Coffee estates. It is an evergreen tree with deeply divided leaves which recall in appearance the fronds of some ferns. The undersurface of the leaves are whitish hairy, a fact that gives this tree its aforementioned common names. The orange-yellow flowers occur in clusters below the leaves.

SPOTTED GLIRICIDIA or MADRE (*Gliricidia sepium*, Fig. 7.29) is a recent introduction from South America. It is grown widely in South India as a shade-tree in plantations and also for hedges. It is a quick-growing tree with arching

branches and feathery foliage. The tree is leafless during the dry season. Left unpruned it develops into a fine spreading tree. Usually however, it is kept down as a hedge or pruned and pollarded to prevent its branches from breaking under the heavy weight of the dense foliage. The leaves thus obtained are excellent as green manure. In various parts of America the bark of this tree is used as a rat-poison.

SQUIRT TREE, SCARLET BELL or FOUNTAIN TREE (*Spathodea campanulata*, Fig. 7.30), originally from tropical Africa, is now planted in many parts of India for shade and also

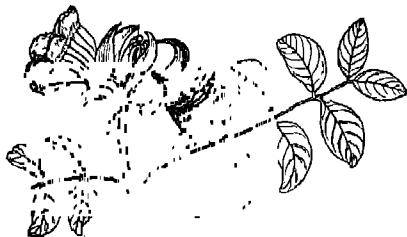


Fig 7.30 Squirt tree



Fig 7.29 Spotted Gliricidia

for its large curved bell-shaped orange and crimson coloured flowers that arise in great profusion during the hot season. An unusual feature is that their soft, brown curved flower buds often contain a quantity of liquid and children take delight in squeezing and squirting it out as a jet after puncturing the

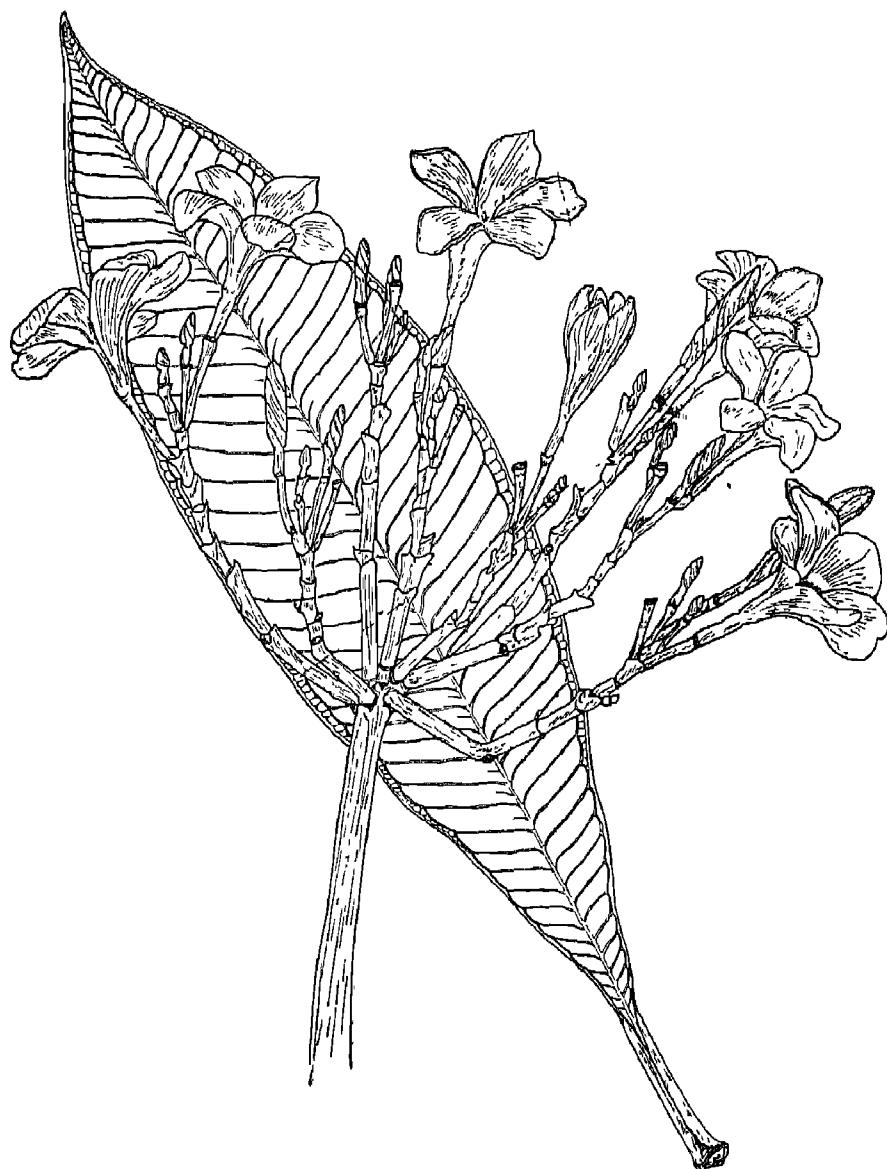


Fig. 731 Temple tree

pointed ends of the buds. It is this fact that gives the tree its name Squirt tree or Fountain tree.

TEMPLE TREE, PAGODA TREE or FRANGIPANI (*Plumeria acuminata*, Fig. 7.31) is actually a native of Mexico and Guatemala but is widely grown in our gardens and parks. It is also planted commonly near temples and graveyards because the Buddhists, Christians and Moslems alike consider it as a tree signifying immortality because of its unusual power of producing leaves and flowers even after it has been lifted off the soil. Different species and varieties are known under cultivation. All are small trees or large bushes with a spreading crown with the simple leaves crowded at the ends of the branches. Neat parallel veins run from the midrib to the edges of the leaves. The older trees may be leafless during part of the year. The large, showy sweet scented flowers however arise almost throughout the year in some places. They bloom and fall to make a flowery carpet beneath. All parts of the tree contain plenty of white sticky latex. The petals, especially in bud, are strongly overlapping to the left or the right. The fruit is an elongated pod but seldom with good seeds which our *malis* explain is because Cobras regularly destroy them since they know that we regard the seeds as a good antidote for their bite! The tree can, however, be readily propagated by cuttings. The latex of the tree as well as its bark are put to many medicinal uses.

THE BASTARD CEDAR (*Guazuma tomentosa*, Fig. 7.32), a small tree and an exotic from tropical America, is often planted especially in the South in gardens and along avenues. The leaves are rough to touch and prominently three-nerved. The small yellow flowers occur in axillary clusters. The petals have

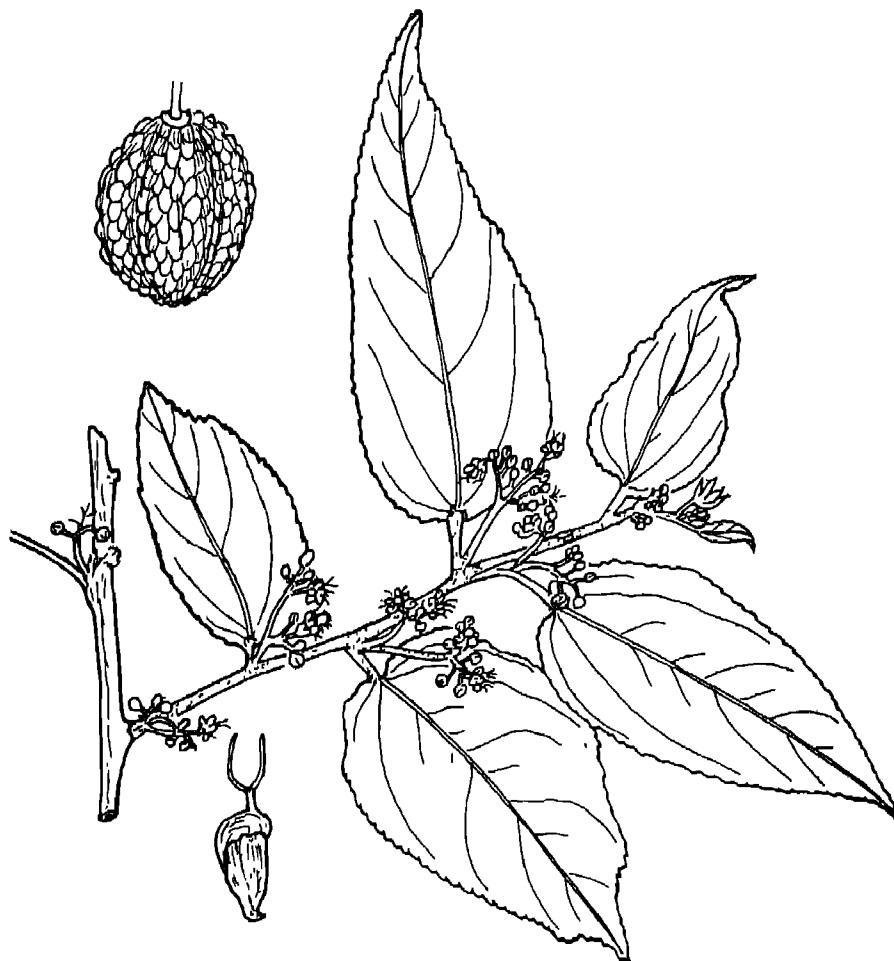


Fig. 7.32 The Bastard Cedar

elongated hairy appendages. The fruit is woody and tubercled recalling that of our native *Rudraksh* and can be used for making rosaries.



Fig. 7.33 Green Wattle

WATTLES (*Acacia* species, Fig. 7.33) are natives of Australia. They are non-phyllode bearing unlike the Australian Blackwood described earlier, and are more like our Babul and Cutch trees in their bipinnately compound leaves. They are commonly grown in the Nilgiris where the Silver Wattle (*Acacia dealbata*) was introduced more than a hundred years ago. The bark of this wattle and particularly of the two other wattles much grown in this area namely the Black Wattle (*Acacia mearnsii*) and the Green Wattle (*Acacia decurrens*) is very valuable as a tanning material in the leather industry. After the felled trees are stripped of their tanbark, the wood is used for fuel. But more recently the wood has found a new use as pulpwood for the Rayon industry in the South.

Epilogue

IN the preceding pages I have endeavoured to present a picture, though necessarily a brief one, and on a broad scale, of the common trees that abound in our great country and the places where they grow naturally or are planted. In addition to meeting our "native sons" among the trees, you have also become acquainted with some of the immigrant species from far off foreign lands. Together, they make an impressive array of trees with a tremendous variety of personalities and uses, living in a diversified range of habitats.

Some of us may now feel better acquainted with our tree neighbours and with the forest communities that we may run into. Others may be eager to meet the members of new forest regions in the North, East and South when the opportunity to travel presents itself. Others may even now be planning a visit next summer to any one of the several hill stations there in the Himalayas—Kashmir, Simla, Manali, Mussoorie, Nainital or Darjeeling; or to Ootacamund, Coonoor or Kodaikanal in the South. If you are more pious and religious you may wish to visit Badrinath or Kedarnath or Amarnath in the high mountains; Varanasi on the banks of the hallowed Ganga; Dwarka, Puri and Rameshwaram on the sea coast. In these and a dozen other places that you may pass or visit we hope that your appreciation of our trees will have been increased by the information presented in this book.

May your friendship with trees grow greater and deeper as the years go by. There are few pleasures to equal that of feeling at home among our tree neighbours, especially when we can

think of these as species and individuals rather than as impersonal stands of timber and so many miles of wilderness to be cut and cleared for building multistorey flats of steel and concrete, for habitation.

Whenever you have to cut a tree, plant two in place of the one you cut down and take good care of the ones that you plant. That should be the true spirit of our Vanamahotsava for the conservation of our tree and forest wealth.

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(Key to the abbreviations And.— Andamans; As.— Assam; B.— Bengal; Bh.— Bhutia; Bo.— Bombay, C.— Coorg; Chamb.— Chamba, E. Himal.— Eastern Himalaya; G.— Gujarat, Garh.— Garhwal, H.— Hindi; H. P.— Himachal Pradesh; K.— Kannada; Kash.— Kashmir; Kh.— Khasi hills, Kum.— Kumaun; Loc.— Local name; Mar.— Marathi, Mal.— Malayalam, M. P.— Madhya Pradesh, N.— Nepali; Or.— Oriya; Pb.— Punjab, Raj.— Rajasthan, S.— Sanskrit; Si— Sindhi; Ta— Tamil; Te.— Telugu, Trd.— Trade name; Vern— Vernacular name; W. Himal.— Western Himalaya)

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	Paala		
	Mar. —Saatwin		
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	H.—Siran		
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	Mal.—Motavaaka Pottavaaga		
	Mar.—Laeli		
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	Ta.—Kaatuirinjil Piliyaagei		
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	Sirish		
	K.—Baage Sirsul		
	Mal.—Vaaka Vaaga		
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	Ta.—Vaagei		
	Te.—Dirasanamu		
	Trd.—Kokko		
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	Chichwa		
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	thagara		
	Vella vaaka		
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	Kilai		
	Or. —Saarapatri		
	Sirsī		
	Ta. —Konda		
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	Velvaagaī		
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		Vilim	
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	K.—Kaadu uti		
	Mal.—Mailaim paala		
	Mar.—Kaala indarjau		
		Kaala	
		Kuda	
	Or.—Pal juwan		
	Ta.—Niila palei		
	Paalei		
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E R R A T A

<i>Page</i>	<i>Line</i>	<i>Read</i>	<i>For</i>
5	2	worshipful	worhipful
5	7	<i>arbor-tristis</i>	<i>arbor tristis</i>
9	1	long-lived	long live
10	3	more	made
20	16	must	most
28	15	identified	indentified
45	11	flattened	flatten
69	7	sweet	sween
86	1	<i>obliqua</i>	<i>oblique</i>
101	1	Rudraksh	Rudrakash
101	Fig 441 (Legend)	Rudraksh	Rudrakash
105	7	frost-free	forest-free
106	12	glands	blands
110	22	Cotton	Coton
110	27	evergreen	evergreens
112	17	parviflora	parviflora
134		Fig 474	Fig 4.47
134	last line	Sycamores	Sycamors
141	6	vary	very
150	11	stems	steams
154	3	constructional	contructional
165	Fig 495 (legend)	Tamarind	Tamarin
206	9	support a	supporta
215	2	Betel-nut	Betal-nut
260	3	CUSTARD	CUSTADR
260	7	Bullock's	Bullovk's
261	23	symbolising	sympolising
261	24	Cupressus	Cppressus